Final
Environmental Assessment

Western Snowy Plover Habitat Restoration

Vandenberg Air Force Base
California

1 August 2008

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 AUG 2008		**00-00-2008 to 00-00-2008**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Final Environmental Assessment: Western Snowy Plover Habitat Restoration, Vandenberg Air Force Base, California	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **ManTech SRS Technologies Inc,12015 Lee Jackson Highway,Fairfax,VA,22033**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**177**	

FINDING OF NO SIGNIFICANT IMPACT

Western Snowy Plover Habitat Restoration at Vandenberg Air Force Base, California

Pursuant to provisions of the National Environmental Policy Act (NEPA), 42 U.S. Code 4321 *et seq.*, implementing Council on Environmental Quality (CEQ) Regulations, 40 Code of Federal Regulations (CFR) 1500-1508, and 32 CFR Part 989, *Environmental Impact Analysis Process*, the U.S. Air Force (Air Force) conducted an assessment of the potential environmental consequences associated with eradicating non-native invasive vegetation from 440 acres of breeding habitat for the western snowy plover *(Charadrius alexandrinus nivosus*, hereafter referred to as snowy plover), on Vandenberg Air Force Base (AFB), California.

The Environmental Assessment (EA), incorporated by reference to this finding, analyzes the environmental consequences of eradicating non-native invasive vegetation from snowy plover breeding habitat. The EA considers all identified potential impacts of the Proposed Action and No-Action Alternative, both as a solitary action and cumulatively with other projects at Vandenberg AFB, and provides guidelines for the proposed activities to avoid adverse environmental effects.

Additionally, Vandenberg AFB is a federal Trustee agency on the Torch/Platform Irene Trustee Council responsible for restoration planning and project implementation to restore natural resources injured by the 1997 Torch Operating Company, Nuevo Energy Company, and Back Hawk Oil & Gas Company oil pipeline spill. This Finding of No Significant Impact constitutes final NEPA analysis by Vandenberg AFB for funding and implementation of the Sandy Beach and Dune Habitat Restoration Project as set forth in the October 24, 2007 Torch/Platform Irene Oil Spill Final Restoration Plan and Environmental Assessment.

PROPOSED ACTION

The Proposed Action consists of implementing habitat restoration for the benefit of the snowy plover and the coastal dune ecosystem within four areas on Vandenberg AFB, and includes removal of invasive, non-native species and revegetation with native dune species where appropriate. Eradication methods for targeted invasive species include manual and mechanical removal, and fire and chemical treatment, and were selected based on site specific criteria and constraints. Active restoration is anticipated to commence in 2008, outside the snowy plover breeding season (March 1 – September 30), with annual monitoring and follow-up treatments for a period of five years.

Under the No-Action Alternative, restoration of snowy plover habitat on Vandenberg AFB would not take place. Current habitat quality and quantity would remain unchanged. Implementation of the No-Action Alternative would preclude satisfying requirements contained in the Biological Opinions issued by the United States Fish and Wildlife Service (USFWS) pertaining to snowy plovers and recreational beach management (USFWS 2001a, 2001b, 2003, 2005).

SUMMARY OF FINDINGS

The analyses of the affected environment and environmental consequences of implementing the Proposed Action concluded that with implementation of the environmental protection and monitoring measures, no adverse effects should result to Hazardous Materials and Waste Management (Section 4.4), Human Health and Safety (Section 4.5), Land Use and Aesthetics (Section 4.6), and Water Resources (Section 4.7). Because the Proposed Action is located within the California Coastal Zone, in accordance with the Coastal Zone Management Act, Vandenberg AFB will submit a Consistency Determination or Negative Determination to the California Coastal Commission, and obtain concurrence prior to initiation of the project. The EA also concluded that the Proposed Action would not affect Earth Resources, Environmental Justice, Noise, Socioeconomics, Solid Waste Management, and Transportation. No cumulative adverse impacts will result from the Proposed Action, when considered with recent past and future projects within the project area (Section 4.8).

Three areas of environmental consequences evaluated in the EA were determined to have the potential to result in less than significant impacts to the environment.

Air Quality

Fugitive dust and combustive emissions generated by equipment and emissions from fire treatments would cause adverse air quality impacts. The largest adverse impacts would occur when vehicles disturb the soil on-site, and during implementation of fire treatment. However, no significant impacts are anticipated (Sections 3.1 and 4.1). Emissions from the Proposed Action would not exceed significance thresholds; therefore, no adverse impacts to the region's air quality would occur. All measures described in the EA will be implemented to further decrease emissions during project activities.

Biological Resources

Habitat restoration has the potential to result in short-term temporary adverse effects to biological resources in the immediate area of disturbance, and permanent beneficial effects from improved habitat and ecological function. No significant adverse impacts to federal threatened and endangered species are anticipated with the implementation of the environmental protection and monitoring measures. On 19 December 2007, the USFWS concurred with the Air Force that no adverse effects would result given the protective measures to be used during implementation of restoration efforts (USFWS 2007b).

Cultural Resources

Activities associated with habitat restoration would not affect any of the cultural resources within or adjacent to the habitat restoration areas. Off-road vehicles would not be permitted within boundaries of known cultural sites. Replanting of native vegetation would be implemented where immediate sand stabilization is required to prevent exposure of buried cultural resources. The cultural resources investigation was a coordinated review that meets the requirements of Section 106 of the National Historic Preservation Act, and the NEPA. Vandenberg AFB reached a Section 106 finding that the Proposed Action would have no adverse

effects to historic properties. This finding will be submitted to the California State Preservation Officer for review.

FINDING OF NO SIGNIFICANT IMPACT

Based upon our review of the facts and analyses contained in the attached EA, conducted in accordance with the provisions of NEPA, the CEQ Regulations, and 32 CFR Part 989, we conclude that the Proposed Action should not have a significant environmental impact, either by itself or cumulatively with other projects at Vandenberg AFB. Accordingly, an Environmental Impact Statement is not required. The signing of this Finding of No Significant Impact completes the environmental impact analysis process.

FINDING OF NO SIGNIFICANT IMPACT
CONCURRENCE PAGE

Environmental Assessment
Western Snowy Plover Habitat Restoration, Vandenberg Air Force Base, California

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8 Sep 08

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Final

Environmental Assessment

Western Snowy Plover Habitat Restoration

Vandenberg Air Force Base

California

Prepared for:

Department of the Air Force
30th Space Wing Civil Engineer Squadron Environmental Flight
Vandenberg Air Force Base, California

1 August 2008

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Acronyms and Abbreviations

%	Percent
µg/m^3	Micrograms per cubic meter
30 CES/CC	30th Civil Engineer Squadron, Commander
30 CES/CEF	30th Civil Engineer Squadron, Fire Protection Flight
30 CES/CEOEC	30th Civil Engineer Squadron, Operations Flight Service Contracts
30 CES/CEV	30th Civil Engineer Squadron, Environmental Flight
30 CES/CEVNC	30th Civil Engineer Squadron, Environmental Flight, Cultural Resources Section
30 SW	30th Space Wing
30 SWP	30th Space Wing Plan
Air Force	United States Air Force
AOC	Area of Concern
AOI	Area of Interest
ATV	All-terrain-vehicle
Base	Vandenberg Air Force Base
BCC	Bird of Conservation Concern
BMP	Best management practice
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCA	California Coastal Act
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon monoxide
CSC	California Species of Concern
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DOD	Department of Defense
EA	Environmental Assessment
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FE	Federally Endangered Species
FR	Federal Register
FT	Federally Threatened Species
FFSRA	Federal Facilities Site Remediation Agreement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographic Information System
H_2S	Hydrogen sulfide
HazMart	Hazardous Materials Pharmacy
IRP	Installation Restoration Program
lbs	Pounds
lbs/day	Pounds per day
MSDS	Material Safety Data Sheet
MSRS	ManTech SRS Technologies

NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Occupational Safety and Health Administration
POL	Petroleum, oil and lubricant
$PM_{2.5}$	Particulate matter 2.5 microns or less in diameter
PM_{10}	Particulate matter 10 microns or less in diameter
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
ROC	Reactive organic compound
RWQCB	Regional Water Quality Control Board
SBCAPCD	Santa Barbara County Air Pollution Control District
SE	State Endangered Species
SLC	Space Launch Complex
SO_2	Sulfur dioxide
SO_4	Sulfates
SRS	SRS Technologies
ST	State Threatened Species
SWPPP	Storm Water Pollution Prevention Plan
tons/yr	Tons per year
UCSB	University of California, Santa Barbara
U.S.	United States
USAF	United States Air Force
U.S.C.	United States Code
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UXO	Unexploded ordnance
VAFB	Vandenberg Air Force Base
VOC	Volatile organic compound

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Chapter 1. Purpose of and Need for the Proposed Action

This Environmental Assessment (EA) evaluates the potential environmental consequences of eradicating non-native invasive vegetation from breeding habitat for the western snowy plover *(Charadrius alexandrinus nivosus*, hereafter referred to as snowy plover), on Vandenberg Air Force Base (VAFB or Base), California, to compensate for the adverse effects of recreational use along 1.25 miles of coastline within said habitat. This EA evaluates effects on the human and natural environment from the Proposed Action and Alternatives.

The National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations require lead agencies to evaluate the potential impacts of federal actions on the surrounding environment. The United States (U.S.) Air Force (Air Force or USAF) is the lead agency for NEPA compliance on the proposed project. This EA has been prepared in accordance with the NEPA of 1969, as amended (42 U.S. Code [U.S.C.] 4321 et seq.); as implemented by CEQ Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); and 32 CFR Part 989.

1.1 Background

The U.S. Fish and Wildlife Service (USFWS) listed the Pacific coast population of the snowy plover as threatened under the Endangered Species Act (ESA) of 1973, on March 5, 1993 (58 Federal Register [FR] 12864). The Pacific Coast population of the snowy plover is limited to individuals that nest adjacent to tidal waters, which include the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries, and coastal rivers. The range of the Pacific coast population extends from southern Washington to Baja California, Mexico, with the majority breeding from southern San Francisco Bay to southern Baja California (Page and Stenzel 1981, Palacios et al. 1994).

The USFWS published a Recovery Plan for the Pacific coast population of the snowy plover in 2007 (USFWS 2007a). The population decline leading to the listing is believed to be poor reproductive success as a result of habitat loss due to coastal development and recreational use of beaches. Other contributing factors to the decline in population size include increased pressure from human-adapted predators associated with increased urban development near nesting areas, additional loss of available nesting habitat due to encroachment by European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus* spp.), and inclement weather (USFWS 2007a).

Final designation of revised critical habitat for this species was published on September 29, 2005 (70 FR 56970). VAFB was excluded from this designation under section 4(b)(2) of the ESA.

Breeding of snowy plovers on the beaches of VAFB was confirmed in 1978 (Page and Stenzel 1981). Basewide censuses conducted in June 1978, May 1989 and May 1991, confirmed the presence of a significant breeding population on VAFB (Page and Persons 1995). Annual monitoring of snowy plover breeding activities on VAFB began in June 1993, and has continued each year through 2008 from March 1 through September 30.

Approximately 11.25 miles of sandy beaches that are snowy plover breeding habitat on VAFB are closed to recreational use during the breeding season, from March 1 through September 30. VAFB allows restricted recreational beach access to 1.25 miles of snowy plover breeding habitat during the breeding season as part of a long-term beach

management plan, for the years 2005 through 2009 (USFWS 2005). This action was also an interim yearly measure during the 2000 through 2004 snowy plover breeding seasons. Military access is available to 0.5 mile of Minuteman Beach and 0.25 mile of Wall Beach, and public access is available to 0.5 mile of Surf Beach (Figure 1-1). A Section 7 consultation with the USFWS and Coastal Zone Management Act (CZMA) consistency review by the California Coastal Commission were completed for this beach management plan.

1.2 Project Location

VAFB is headquarters for the 30th Space Wing (30 SW). The Air Force's primary missions at VAFB are to launch and track satellites in space, test and evaluate America's intercontinental ballistic missile systems, and support aircraft operations in the Western Range. As a non-military facet of operations, VAFB is also committed to promoting commercial space launch ventures.

VAFB is located on the south-central coast of California, approximately halfway between San Diego and San Francisco (Figure 1-2). The Base covers approximately 99,000 acres in western Santa Barbara County (VAFB 2007) and occurs in a transitional ecological region that includes the northern and southern distributional limits for many plant and animal species.

The Santa Ynez River and State Route 246 physically divide the Base into two parts. The area to the north of the Santa Ynez River is commonly referred to as North Base, and the area to the south as South Base.

The Proposed Action and Alternatives would affect approximately 3.1 miles of coastal beaches at several locations on North and South Base. Snowy plover breeding habitat on VAFB occurs along approximately 12.5 miles of coastline and is identified in Figure 1-2. Snowy plovers breed along 7.7 miles of coastline on North Base (Minuteman, Shuman, San Antonio, Purisima North and Purisima Colony), referred to as North Beaches. In addition, Wall Beach and Surf Beach, taken together, form a contiguous 4.8-mile stretch of beach extending north and south of the Santa Ynez River estuary, and are commonly referred to as South Beaches.

1.3 Purpose and Need

As part of VAFB's snowy plover management, the USAF proposes to eradicate non-native dune vegetation to offset the adverse effects of recreational access along 1.25 miles of coastline within snowy plover habitat. The activities involved in the eradication of non-native dune vegetation are detailed in the *Final Plan for the Removal of Selected Invasive Plants from Western Snowy Plover Habitat at Vandenberg Air Force Base* (hereafter referred to as Restoration Plan; SRS Technologies [SRS] 2005), and incorporated in USFWS Biological Opinions 1-8-01-F-13 (USFWS 2001a), 1-8-02-F-7 (USFWS 2001b), 1-8-03-F-13 (USFWS 2003), and 1-8-05-F-5R (USFWS 2005) issued to the Air Force. These Biological Opinions require the funding and collaborative execution of habitat restoration on VAFB that will improve habitat for the benefit of the snowy plover while ensuring minimal disturbance to the species.

In April 2005, the Restoration Plan (SRS 2005) was approved by the USFWS (see Appendix A). The need for this project arises from the continued degradation of snowy plover habitat on VAFB, due to the increasing presence of non-native invasive plant species, and the VAFB Environmental Flight commitment to meet the terms and conditions contained in the Biological Opinions issued for recreational beach management and snowy plovers described above. The Air Force proposes to start implementation of this Restoration Plan in 2008.

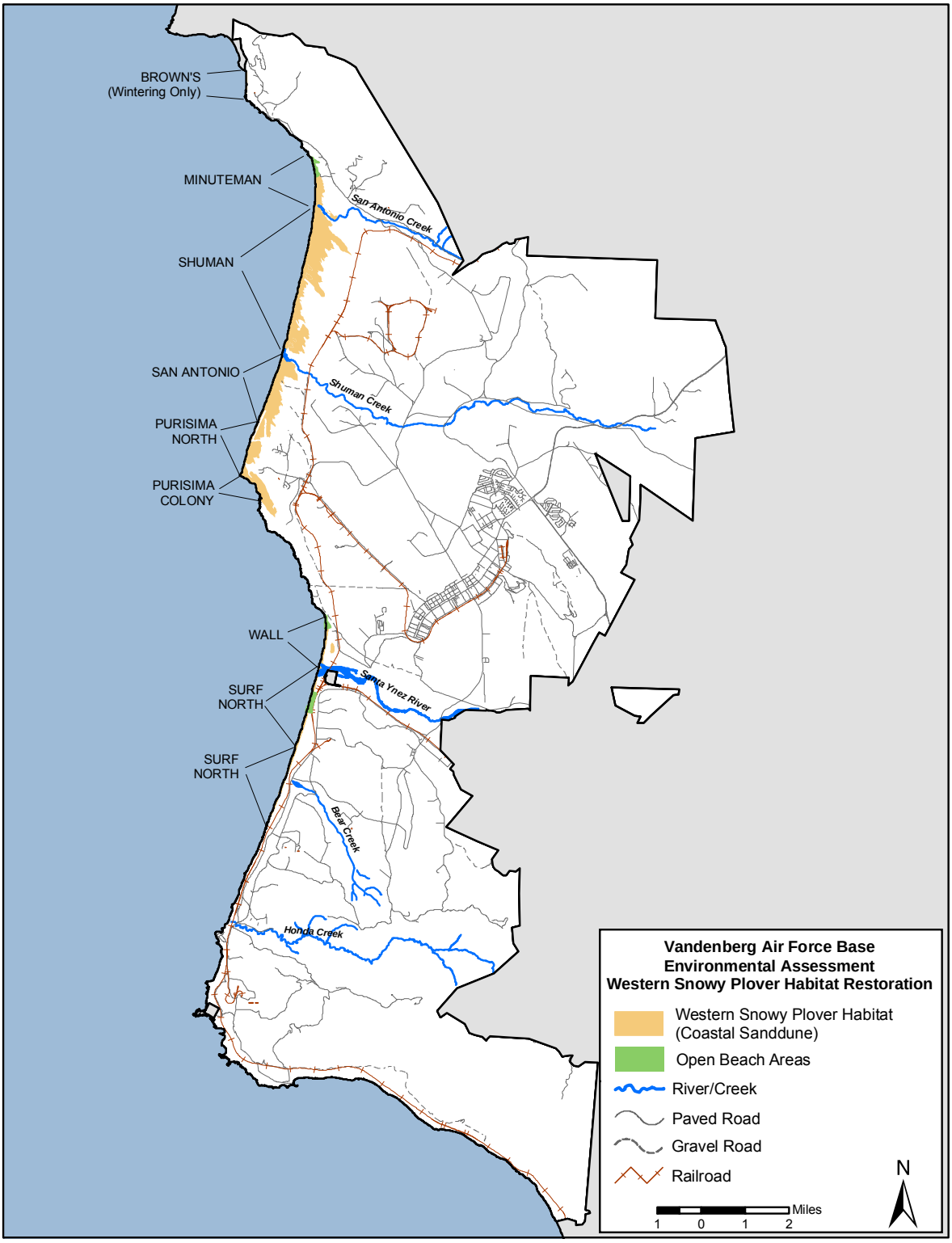

Figure 1-1. Snowy plover habitat on VAFB.

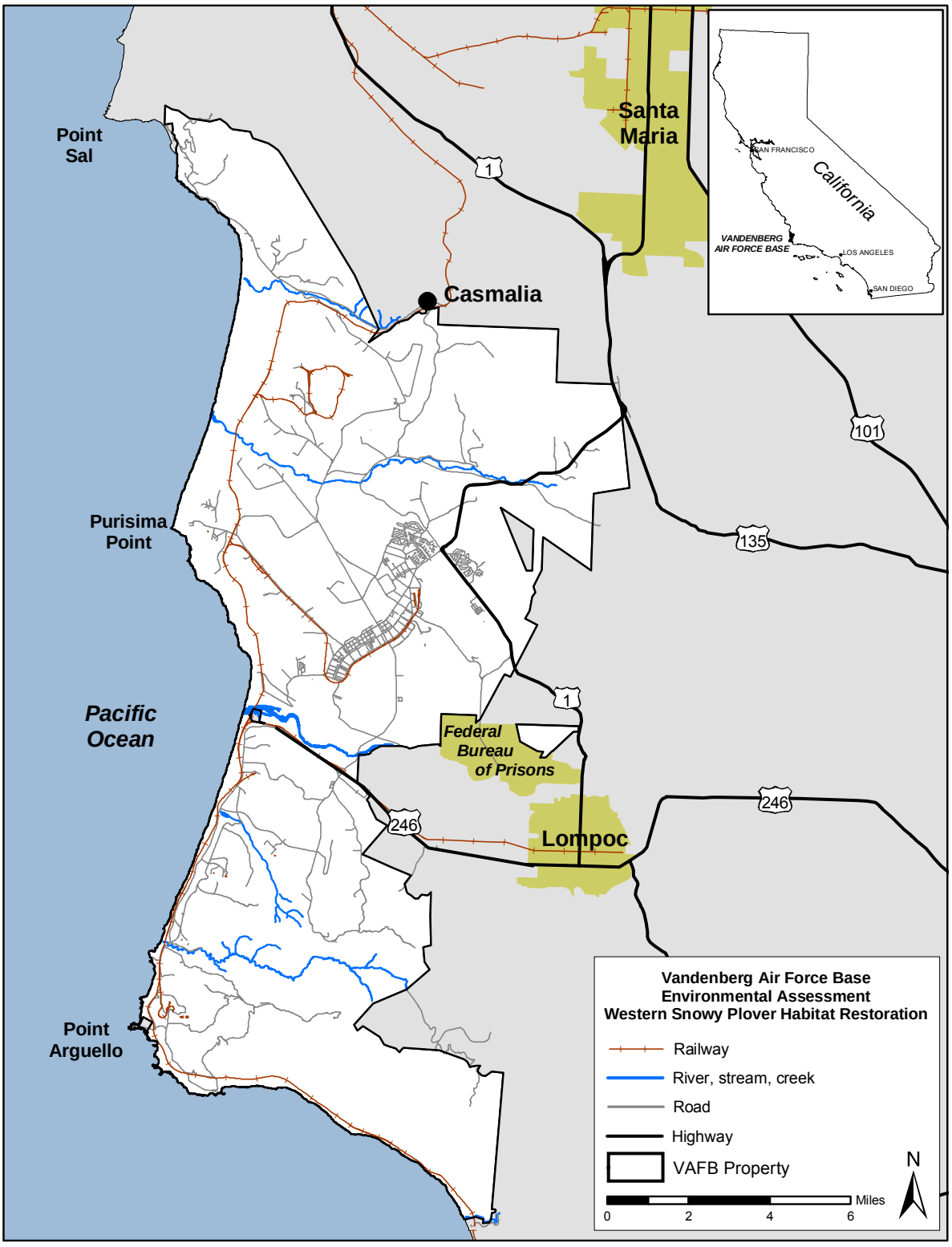

Figure 1-2. Regional location of VAFB.

1.4 Scope of the Environmental Assessment

Consistent with Title 32 CFR Part 989, and CEQ regulations (40 CFR 1500-1508), the scope of analysis presented in this EA is defined by the potential range of environmental impacts resulting from implementing the Proposed Action and Alternatives. Pursuant to 40 CFR Part 1501.4(c), resources potentially impacted are considered in more detail in order to provide sufficient evidence and analysis to determine whether or not to prepare an environmental impact statement.

This EA identifies, describes, and evaluates the potential environmental impacts that could result from the Proposed Action, the No-Action Alternative, and other viable alternatives.

Possible cumulative impacts from other past, present, and planned actions on VAFB are considered and evaluated. In addition, the EA identifies environmental permits relevant to the Proposed Action and Alternatives. As appropriate, the EA describes, in terms of a regional overview or a site-specific description, the affected environment and environmental consequences of the Proposed Action and Alternatives, and identifies management measures to prevent or minimize environmental impacts.

Resources analyzed in this EA include air quality; biological resources; cultural resources; hazardous materials and hazardous waste management; human health and safety; land use and aesthetics; and water resources.

The following resources were considered but not analyzed in this EA:

- *Earth Resources*. The methods selected for habitat restoration would not affect geology or soils. All activities under the Proposed Action and Alternatives would occur at or above current or historic grade levels.

- *Environmental Justice*. Per Executive Order 12898, *Environmental* Justice, the potential effects of the Proposed Action and Alternatives on minority communities and low-income communities were considered. Because the Proposed Action and Alternatives would occur within VAFB boundaries, it would not affect low income or minority populations with the region (Lompoc Valley and Santa Maria Valley). Access to Surf/Ocean Beach would not be allowed for 2 to 4 days during eradication efforts. However, this would not represent an adverse effect on low-income and minority populations.

- *Noise*. The Proposed Action and Alternatives would occur within an undeveloped area of VAFB. Personnel working on VAFB and the surrounding communities would not be exposed to noise disturbance associated with project activities. In addition, the small amount of noise generated by equipment during project implementation is not anticipated to significantly affect individuals directly associated with project activities.

- *Socioeconomics*. The short-term nature (approximately 5 months a year for 5 years) and the minimal manning (one to three workers at a time) associated with the Proposed Action and Alternatives would not affect the socioeconomic conditions of the region (Lompoc Valley and Santa Maria Valley).

- *Solid Waste Management*. It is anticipated that minimal amounts of solid waste would be generated during project implementation. No demolition or deconstruction debris would be generated. All activities associated with the Proposed Action and Alternatives would be performed in accordance with VAFB's *Pollution Prevention Management Plan*. Contractors would be required to appropriately dispose of any solid waste generated either at the VAFB Sanitary Landfill as appropriate, or off Base property.

- *Transportation*. Because the Proposed Action and Alternatives would only involve work by a crew of two or three persons, it would not result in an inordinate increase in

traffic. Therefore, transportation within the area or region would not be affected.

A list of acronyms and abbreviations used in this EA is included after the Table of Contents.

1.5 Applicable Regulatory Requirements

Federal and state regulations applicable to the Proposed Action and Alternatives are summarized in Table 1-1 and further described in Chapters 3 and 4. Regulatory requirements are applicable for six categories: air quality, water quality, coastal resources, hazardous waste, biological resources, and cultural resources.

Table 1-1. Federal and state regulations applicable to the implementation of the Proposed Action and Alternatives.

Federal Regulation	Activity or Requirement
American Indian Religious Freedom Act of 1978 (42 U.S.C 1996)	The American Indian Religious Freedom Act states that the policies and procedures of federal agencies must comply with the constitutional clause prohibiting abridgment of religious freedom—including freedom of belief, expression, and exercise—for Native Americans. The American Indian Religious Freedom Act policy is to consider Native American access to sites, use and possession of sacred objects, and freedom to worship, and directs federal agencies to revise policies and procedures to correct conflicts with Native American religious cultural rights and practices.
Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469a et seq.)	The Archaeological and Historic Preservation Act is directed toward the preservation of historic and archaeological data that would otherwise be lost as a result of federal construction or other federally licensed or assisted activities. The Archaeological and Historic Preservation Act authorizes the Department of the Interior to undertake recovery, protection, and preservation of archaeological or historic data.
Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm), Supplemental Regulations of 1984	The Archaeological Resources Protection Act secures protection of archaeological resources and sites on public and Indian lands; requires permitting for any excavation or collection of archaeological material from these lands; and provides civil and criminal penalties for violations.
Clean Air Act of 1970 (42 U.S.C. 7401 et seq.)	The Clean Air Act states that applicable national ambient air quality standards must be maintained during the operation of any emission source. National Ambient Air Quality Standards include primary and secondary standards for various pollutants. The primary standards are mandated by the Clean Air Act to protect public health, while the secondary standards are intended to protect the public welfare from adverse impacts of pollution, such as visibility impairment.
Clean Air Act Amendments of 1990	These amendments establish new federal non-attainment classifications, new emissions control requirements, and new compliance dates for areas in non-attainment. The requirements and compliance dates are based on the non-attainment classification.
Clean Water Act of 1977 as amended (33 U.S.C. 1251 et seq.)	Prohibits the discharge of pollutants from a point source into navigable Waters of the US, except in compliance with a National Pollutant Discharge Elimination System (40 CFR Part 122) permit. Navigable Waters of the US are considered to encompass any body of water whose use, degradation, or destruction will affect interstate or foreign commerce. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Activities in waters of the US that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. Section 401 of the Clean Water Act requires that the discharge of dredged or fill material into water of the U.S. does not violate state water quality standards. Generally, no Clean Water Act Sec. 404 permits will be issued until the State has been notified and the applicant has obtained a certification of state water quality standards.
Coastal Zone Management Act of 1972 (16 U.S.C. 2452-24645).	The Coastal Zone Management Act plays a significant role in water quality management. Under the Act, a federal action that may affect the coastal zone must be carried out in a manner that is consistent with state coastal zone management programs.

Federal Regulation	Activity or Requirement
Endangered Species Act of 1973 (7 U.S.C. 136; 16 U.S.C. 460 et seq.)	Declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which these species depend. The Endangered Species Act requires that federal agencies, in consultation with the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration National Marine Fisheries Service, use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species.
Section 7 of the Endangered Species Act (16 U.S.C. 1536)	Contains provisions that require federal agencies to consult with the Secretary of Interior and to take necessary actions to ensure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of endangered species and threatened species.
Energy Policy Act of 1992 as amended (42 U.S.C. 8256 et seq.)	The Energy Policy Act requires that federal agencies significantly reduce their use of energy and reduce environmental impacts by promoting the use of energy-efficient and renewable energy technologies.
Migratory Bird Treaty Act of 1918 as amended (16 U.S.C. 703-712)	The Migratory Bird Treaty Act implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.
National Environmental Policy Act of 1969 as amended (42 U.S.C. 4321-4347)	Requires federal agencies to analyze the potential environmental impacts of major federal actions and alternatives and to use these analyses as a decision-making tool on whether and how to proceed.
National Historic Preservation Act of 1966 as amended (16 U.S.C. 470 et seq.)	The National Historic Preservation Act is the key federal law establishing the foundation and framework for historic preservation in the U.S. The Act authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places, establishes an Advisory Council on Historic Preservation as an independent federal entity; requires federal agencies to take into account the effects of their undertakings on historic properties, and to afford the Council an opportunity to comment upon any undertaking that may affect properties listed, or eligible for listing, in the Register; and makes the heads of all federal agencies responsible for the preservation of historic properties owned or controlled by them.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3013)	The Native American Graves Protection and Repatriation Act restores certain rights to Native Americans with respect to the disposition of ancestral human remains and cultural objects; vests ownership of these materials (from federal or tribal lands) with designated Native American groups; requires notification of federal agency head when Native American cultural items are discovered on federal or tribal lands; prohibits trafficking in Native American human remains and cultural items; requires inventory and tribal notification of human remains and associated funerary objects held in existing collections by museums or federal agencies; and provides for repatriation of these materials.
Noise Control Act of 1972 (42 U.S.C. 4901 et seq.)	The Noise Control Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of federal research and activities in noise control, authorizes the establishment of federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products. The Act authorizes and directs that federal agencies, to the fullest extent consistent with their authority under federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. 4901. Each department, agency, or instrumentality of the executive, legislative and judicial branches of the federal government having jurisdiction over any property or facility or engaged in any activity resulting, or which may result in, the emission of noise shall comply with federal, state, interstate, and local requirements respecting control and abatement of environmental noise.
Occupational Safety and Health Act of 1970 (29 U.S.C. 659-678)	The Occupational Safety and Health Act was established to assure safe and healthful working conditions for working men and women by: authorizing enforcement of the standards developed under the Act; by assisting and encouraging the states in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes.
Pollution Prevention Act of 1990	The Pollution Prevention Act establishes that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and that disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

Federal Regulation	Activity or Requirement
Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.)	The Resource Conservation and Recovery Act gives the U.S. Environmental Protection Agency the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. The Act also sets forth a framework for the management of non-hazardous wastes.
State Regulation	**Activity or Requirement**
California Coastal Act of 1976	The California Coastal Act provides long-term protection of California's 1,100-mile coastline for the benefit of current and future generations. Coastal Act policies constitute the standards used by the Coastal Commission in its coastal development permit decisions and for the review of local coastal programs prepared by local governments and submitted to the Commission for approval. These policies are also used by the Commission to review federal activities that affect the coastal zone.
Clean Air Act of 1988	The Clean Air Act develops and implements a program to attain the California Ambient Air Quality Standards for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter less than or equal to 10 microns in diameter, lead, sulfates, hydrogen sulfide, and vinyl chloride. 40 CFR Part 51 gives state and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the Air Resources Board are included in the State Implementation Plan. When approved by the U.S. Environmental Protection Agency, these rules become federally enforceable.
Porter-Cologne Water Quality Control Act	Protects all waters of the state for the use and enjoyment of the people of California and declares that the protection of water resources be administered by the regional water quality control boards.
California Integrated Waste Management Act of 1989, California Assembly Bill AB 939	Provides for the proper management and disposal of solid wastes, to include the diversion requirements for construction and demolition debris.

Chapter 2. Description of the Proposed Action and Alternatives

This chapter describes the Proposed Action, No-Action Alternative, and other identified Alternatives. The chapter provides detailed descriptions of equipment needs, construction requirements, and operational parameters for the proposed restoration of snowy plover habitat on VAFB, California.

The descriptions provided in this chapter are based on the Restoration Plan (SRS 2005) approved by the USFWS, and on field surveys completed to assess the feasibility of implementing the Proposed Action. Field surveys were completed under the direction, and with the participation, of the 30th Civil Engineer Squadron, Environmental Flight (30 CES/CEV) and 30th Civil Engineer Squadron, Fire Protection Flight (30 CES/CEF).

2.1 Alternative A: Proposed Action

The goal of the proposed project is to increase the amount of breeding habitat available to snowy plovers on VAFB, with minimal adverse effects to the species during its implementation. The Air Force proposes to implement habitat restoration for the benefit of the snowy plover and the coastal dune ecosystem. The Proposed Action includes: removal of invasive, non-native species in selected areas; revegetation with native dune species where appropriate; and annual maintenance, as needed, to prevent re-establishment of non-native species. Invasive species targeted for removal include:

- European beachgrass (hereafter referred to as beachgrass);
- iceplant; and,
- Sydney golden wattle (*Acacia longifolia*; hereafter referred to as acacia).

Beachgrass forms dense monotypic stands, and can dramatically alter dune structure through sand accumulation. Beachgrass encroachment was identified as being "one of the most significant causes of habitat loss for coastal breeding snowy plovers" (USFWS 2007a). Iceplant forms dense mats and has the potential to alter dune structure, although to a lesser degree than beachgrass. The effects of both these species can result in unfavorable nesting conditions for the snowy plover. Therefore, these invasive plant species have been targeted for removal from selected areas of snowy plover habitat on VAFB based on their effect on natural communities. In addition, acacia is targeted for removal within selected project areas. Invasive species targeted for removal during restoration efforts are described in detail below.

Beachgrass

Beachgrass is the most pervasive exotic plant species threatening coastal dunes on the west coast of the U.S. (Pickart 1997). This species is a perennial grass that occurs in coastal dunes with clumped, stiff, upright stems. Native to the coast of Europe and North Africa, it was first planted in 1869 on the Pacific Coast near San Francisco's Golden Gate Park (Bossard et al. 2000). It was later used extensively on the west coast to stabilize sand dunes. Today, beachgrass is invasive in every major dune system from Santa Barbara County, California, to the northernmost dunes of Washington.

Beachgrass spreads almost exclusively by rhizomes, and rarely establishes by seed (Bossard et al. 2000). These rhizomes grow very quickly; in 6 months, they can extend laterally over 6.5 feet (2 meters) (Aptekar 1999). Shoots grow vigorously in spring with growth slowing, but not stopping, in winter (Huiskes 1979). At VAFB, active growth

would be expected to occur mainly from February through June, based on the amount of available daylight and moisture. Beachgrass grows most vigorously with continuous sand accretion and can form expansive monospecific stands (Bossard et al. 2000). Expansion rate can also be affected by environmental conditions such as rainfall and plant community dynamics (USFWS 2007a).

Through sand accretion, beachgrass can drastically change beach topography. It creates steep foredunes and alters dune formation to run parallel to the coast. Native grasses promote dunes running almost perpendicular to the coast (Cooper 1967, Barbour and Johnson 1988, Wiedemann and Pickart 1996). Vegetated foredunes, dominated by beachgrass, also effectively block sand from moving inland. This creates favorable conditions for dense vegetation to establish itself in the deflation plain behind the foredunes (Wiedemann et al. 1969), and as such, the open features characteristic of snowy plover breeding habitats are destroyed (USFWS 2007a).

Beachgrass is known to form a dense cover that can prevent native plant species from becoming established in these areas. Areas dominated by beachgrass have shown vegetative species richness that is half of what is present on foredunes dominated by native dune grass (Barbour and Major 1990). Native dune plants do not bind sand in the same manner as beachgrass; therefore sand movement and regeneration of open expanses of sand is possible with these species (USFWS 2001a). The stabilization of sand by beachgrass allows plant and animal species, which are normally found further inland in the coastal dune scrub, to become established nearer to the coastal strand.

Laye and Mangione (USFWS 1995) report that many areas on VAFB show "total domination of historic habitat" and note that beachgrass has reduced the width and slope of beach habitat south of Ocean Beach, which was previously broader and more gently sloped. In addition, beachgrass may provide habitat for predators of snowy plovers that might not have used the beach without the additional cover provided (USFWS 1993). Potential predators include weasels, skunk, coyote, loggerhead shrike, and other birds of prey. Increased predation could reduce breeding success.

Pickart (1997) stresses that, as with any exotic plant infestation, it is critical to prevent expansion of beachgrass into any new, pristine areas, and that this principle is applicable at both local and regional levels.

Iceplant

Iceplant contributes to the stabilization of dune sands, changing the natural dune community processes over time (Bossard 2000). Iceplant can also indirectly affect the communities it invades by building up organic matter in normally sandy beach and dune soils, which can result in invasion by non-native plants that normally would not be able to establish in sandy soils (Bossard et al. 2000). These factors make iceplant capable of changing the physical composition and the quality of snowy plover habitat.

Highway iceplant (*Carpobrotus edulis)*, native to coastal areas of South Africa, is a perennial ground-hugging succulent that often forms deep mats that cover large areas (Bossard et al. 2000). Starting in the early 1900s, highway iceplant was used in California to stabilize soil along railroad tracks; by the 1970s thousands of acres had been planted for similar purposes (Bossard et al. 2000).

Highway iceplant can reproduce vegetatively and by seed. Active growth appears to occur year round and D'Antonio (1990b) reports that individual shoot segments can grow more than 3.3 feet (1 meter) per year. In California, flowering occurs throughout the year and flowers are described as being yellow or light pink (Bossard et al. 2000). Fruits, which mature on the plant, are eaten by mammals such as deer and rabbits and pass through their digestive system, enhancing germination (Bossard et al. 2000). Iceplant easily spreads to pristine areas via mammals (D'Antonio 1990a).

Highway iceplant and its close relative, sea fig (*Carpobrotus chilensis*), readily hybridize throughout their range in California (Bossard et al. 2000), including on VAFB. Sea fig is described to be more diminutive and less aggressive than highway iceplant, and to have smaller flowers that are deep magenta (Bossard et al. 2000). Due to the commonness of hybridization, both species and hybridized individuals will hereafter be referred to as iceplant.

Individual branch segments of iceplant can survive, even when isolated from the rest of the plant, because it can produce roots from every node. For this reason, even shoot segments can propagate (Bossard et al. 2000). This accounts for the density of iceplant stands, and the ability of the plant to accumulate sand at a higher rate than native dune plants.

Acacia

Acacia is native to southeastern Australia (Costermans 1981). It favors disturbed sites, especially sandy soils. In California, it occurs in the San Francisco Bay Area south through the coastal ranges at up to 492 feet (150 meters) in elevation.

Acacia seeds remain viable for long periods of time, stored in the soil where germination occurs through fire stimulation or disturbance (Dennil et al. 1993).

The proposed project would be considered successful if the following objectives are met:

- Targeted invasive species are removed from or minimized in selected areas, within five years of project initiation.
- Selected areas are restored to possess the dune structure and native plant composition characteristic of historic snowy plover nesting habitat on VAFB and habitat as described in the final designation of revised critical habitat for the Pacific Coast Population of the Western Snowy Plover.
- Selected areas are maintained free of targeted invasive species, and no infestation of new non-native invasive species occurs during the 5 years of restoration and monitoring activities.

2.1.1 Eradication Methods

Several eradication methods for non-native invasive species would be used under the Proposed Action, as discussed in detail below.

2.1.1.1 Manual Removal

This method would be used to create firebreaks and all-terrain-vehicle (ATV) access. Vegetation would be cleared and excavated using hand tools. Excavated material would be hand raked into piles and left in place until fire treatment can be applied to eliminate the dead biomass.

2.1.1.2 Mechanical Removal

This method would be used for removal of Acacia trees, and vegetation for clearance of access roads and firebreaks.

A steel tracked backhoe type vehicle with an articulating arm would be used to fell acacia trees and process material into smaller pieces. The smaller material would be hand raked into piles and left in place until fire treatment can be applied to eliminate the dead biomass. An area of approximately 7 acres would be required for this use.

A bulldozer would be used to remove vegetation for clearance of access roads and firebreaks within selected project locations. Existing gravel roads would be cleared of vegetation to the road base to allow equiment access to the project area. Vegetation would be piled and left in place until fire treatment can be applied to eliminate the dead biomass. In addition, strips of land would be cleared of vegetation to bare mineral soil to prevent or retard the spread of fire in the event of an emergency. Vegetation would be processed into smaller pieces and incorporated into the soil.

2.1.1.3 Fire Treatment

Application of fire treatment would be used to eliminate the dead biomass within large, well

established beachgrass infestations with heavy thatch build up, and processed vegetative material. Firebreaks would be cleared at selected locations to prevent or retard the spread of fire in the event of an emergency. The 30 CES/CEF would perform all fire treatment activities. Selected project areas would be broadcast burned by hand using drip torches.

2.1.1.4 Chemical Treatment

Chemical treatment involves the application of a post-emergent herbicide at a selected concentration for individual species. After herbicide application, plants would be allowed to decompose naturally without physical removal to discourage erosion, act as an organic mulch, and aid in the retention of nutrients and water.

Small patches of newly established beachgrass infestations, windward faces of beachgrass ridges where heavy thatch does not build up, and beachgrass sprouts following fire treatment, would be treated with a 5 to 7 percent glyphosate (Roundup PRO®). Iceplant infestations would be treated with a 2 to 4 percent glyphosate. Glyphosate would be combined with a non-ionic surfactant (surface active agent) designed to improve the dispersing/emulsifying, absorbing, spreading, sticking, and/or pest-penetrating properties of the spray mixture, and a biodegradable agricultural marker dye. Spot treatments would be applied using a backpack sprayer or ATV mounted spray assembly with hose, to selectively spray targeted species while avoiding surrounding vegetation.

A 50 percent concentration of triclopyr (Garlon 4 Ultra®) would be hand painted on the outer surface of acacia stumps exhibiting regrowth. Acacia saplings would be treated with a 2 to 4 percent glyphosate until the seedbank is exhausted.

2.1.2 Dune Contouring

Mechanical contouring of dunes would occur within selected locations after adequate invasive plant removal has been completed. Contouring would be employed where the remaining dune is 2 feet or higher than the adjacent intertidal flats to create dune structures optimal for snowy plover breeding habitat. A bulldozer would be used to move sand within the selected project area. All excess sand would be deposited within the upper portion of the tidal zone. Wave action and long shore current flow is expected to redistribute the sand along the beach.

2.1.3 Revegetation

Replanting of native vegetation encourages the establishment of desired species during restoration efforts, and can prevent the encroachment of invasive species after they are removed. It is anticipated that some revegetation would occur naturally in areas where invasive plants are removed, and native species are retained or are present nearby. Intentional revegetation would be implemented in areas where:

- Dune contouring has occurred, as the seed bank of most native and special status species would be removed or buried too deep for proper germination to occur.
- Immediate sand stabilization is required to prevent exposure of buried sensitive cultural resource sites.
- Burial of special status plant species may occur due to windward sand movement.

Revegetation techniques include containerized stock planting and direct seeding. Native plant species that would be used in intentional revegetation efforts are listed in Table 2-1. This list comprises the majority of species occurring naturally within

Table 2-1. Native plant species to be used in active revegetation efforts.

Common Name	Scientific Name
Beach sand verbena	*Abronia maritima*
Beach bur	*Ambrosia chamissonis*
Beach evening primrose	*Camissonia cheiranthifolia*
California saltbush	*Atriplex californica*
Beach saltbush	*Atriplex leucophylla*
Dunedelion	*Malacothrix incana*

snowy plover breeding habitat, and that occur on VAFB (Keil and Holland 1998). Native seed would be collected prior to the start of eradication efforts within the proposed restoration sites and surrounding areas.

Replanting of native perennials propagated from seed would be used to create habitat of the composition similar to adjacent snowy plover breeding habitat within each area. Irrigation would be supplied at the time of outplanting using a backpack sprayer.

In addition to revegetation, hand-planted straw bundles and erosion control blankets (jute netting) may be used in areas necessary to immediately stabilize sand movement, while allowing for plant growth.

2.1.4 Project Areas

Beachgrass and iceplant are present within the majority of snowy plover breeding habitat on VAFB. Acacia is restricted to a small area on South Beaches. Areas targeted for restoration were selected based on their potential for increasing or maintaining available nesting habitat, although other factors such as equipment access were also considered by necessity. The following criteria were used in the selection process:

- **Criteria 1**: Areas with significant nesting numbers (as compared to other areas on VAFB) which face an imminent threat of further degradation from invasive species currently within the area.
- **Criteria 2**: Areas containing invasive species that, when restored, would create large areas free of invasive species, or join other existing, relatively undisturbed, dune vegetation types, to create a large continuous area of available breeding habitat.
- **Criteria 3**: Areas in close proximity to an area of relatively high snowy plover breeding activity, where removal of the isolated patches of invasive species would prevent future spread.
- **Criteria 4**: Areas that would be exposed to minimal human disturbance during the breeding season.
- **Criteria 5**: Areas where adverse effects to cultural resources would be minimal or avoidable.
- **Criteria 6**: Areas where reasonable access is available to reach the invasive species with the equipment necessary for the chosen removal technique.

Based on the selection criteria, four areas are proposed for habitat restoration on VAFB: three sites on San Antonio Beach between the south side of San Antonio Creek and the south end of the beach; and one site on Surf Beach extending from the Santa Ynez River to the northern boundary of the area near Surf Railroad Station that is open to recreational use during the snowy plover breeding season. Areas proposed for habitat restoration are described in detail below. Figures 2-1 through 2-4 show detailed locations of project activities under the Proposed Action.

Under the Proposed Action, restoration efforts would occur at specific sites within a total of approximately 440 acres of snowy plover habitat. Non-native invasive plant species were surveyed within each project area in 2008, and approximate coverages were estimated (Table 2-2). Site specific restoration activities at each of the four project areas are described below.

2.1.4.1 Area A

Area A is located immediately south of the San Antonio Creek mouth (Figure 2-1Figure 2-1) and extends southward along the Pacific Coast for approximately 0.56 mile. Area A is comprised of approximately 7 acres of snowy plover breeding habitat.

Approximately 1.5 acres of mixed beachgrass/iceplant infested dunes, and solitary patches of iceplant (approximately 0.5 acre total), are targeted for removal in Area A. Area A meets selection Criteria 3 and Criteria 4.

Access to Area A would be on ATV, restricted to a designated sand access route beginning at Road 3. Road 3 is a gravel road located west of North Spur Road, approximately 1 mile northwest of Area A. A staging area

Table 2-2. Approximate coverage of invasive species within each project area.

Area	Acreage			
	Beachgrass	Iceplant	Mixed Beachgrass/Iceplant	Acacia
A		0.5	1.5	
B	0.1	10.0	57.0	
C	0.1		0.2	
D	22.0	1.0		6.0
Total	22.2	11.5	58.7	6.0

for fueling and maintenance (if required) would be located at the west end of Road 3 (see Figure 2-1).

Fire treatment would be used to eliminate the dead aboveground biomass within large beachgrass infestations. Chemical treatments would be used to eliminate the iceplant in this area, as well as isolated beachgrass infestations, and beachgrass sprouts following fire treatment.

Revegetation would occur within Area A as described in Section 2.1.3.

2.1.4.2 Area B

Area B is located at the south end of San Antonio Beach (Figure 2-2) and is comprised of approximately 120 acres of snowy plover breeding habitat. This area is approximately 0.78 mile long and in some places extends up to 0.28 mile inland.

Ridges containing mixed beachgrass/iceplant (approximately 57 acres), and small patches of iceplant (approximately 10 acres) and beachgrass (approximately 0.1 acre) are targeted for eradication within Area B. It is anticipated that removal of beachgrass and iceplant within this area would result in higher use by breeding snowy plovers, through the creation of a large area of continuous habitat extending approximately 0.19 mile inland. Area B meets selection Criteria 2 and Criteria 4.

Access to the southern inland portion of Area B would be through Space Launch Complex (SLC) -10. Approximately 0.2 mile of an existing abandoned gravel road, would be mechanically cleared of vegetation to the existing road base for equipment access. This road would also serve as a firebreak and an equipment staging area.

Access to the northern coastal portion of Area B would be via an access route off Road 3. A staging area would be located east of this access route. To allow ATV access within Area B, approximately one-half acre of sand ridges created by beachgrass may be cleared of vegetation and hand excavated, to no more than 5 inches below grade to avoid adverse effects to cultural resources.

As described in Section 2.1.1, fire treatment would be used to eliminate the dead above ground biomass within large beachgrass infestations. Approximately 0.1 acre of vegetation would be mechanically removed to create a firebreak east of Area B. Chemical treatments would be used to eradicate the iceplant as well as isolated beachgrass infestations, and beachgrass sprouts following fire treatment. Revegetation would occur within Area B according to the criteria described in Section 2.1.3.

2.1.4.3 Area C

Area C is located between Areas A and B (Figure 2-3), and consists of many relatively small patches of mixed beachgrass/iceplant (approximately 0.2 acre) and some beachgrass (less than 0.1 acre). Area C encompasses approximately 260 acres of snowy plover breeding habitat. Area C meets selection Criteria 1 and Criteria 4. Without

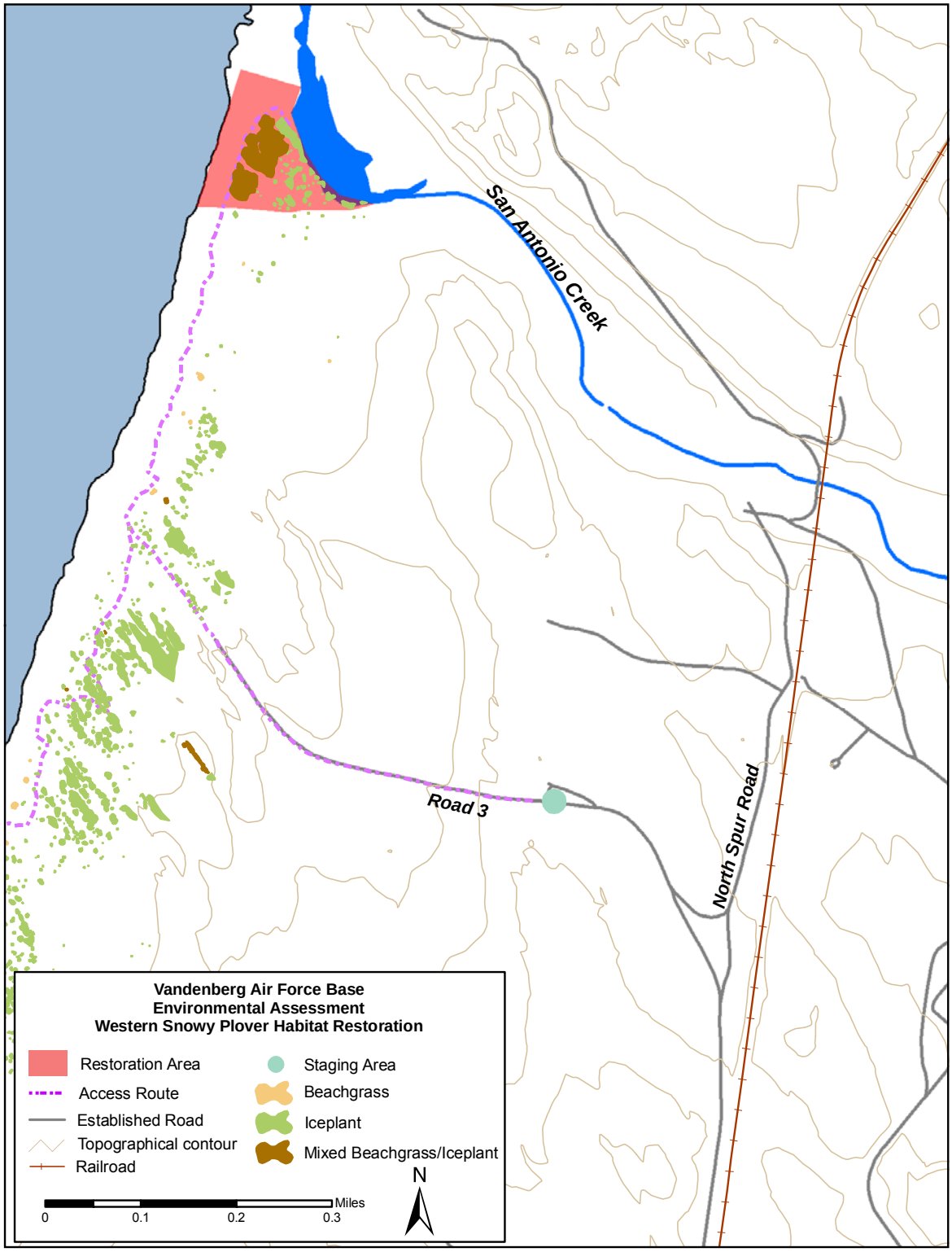

Figure 2-1. Area A project location.

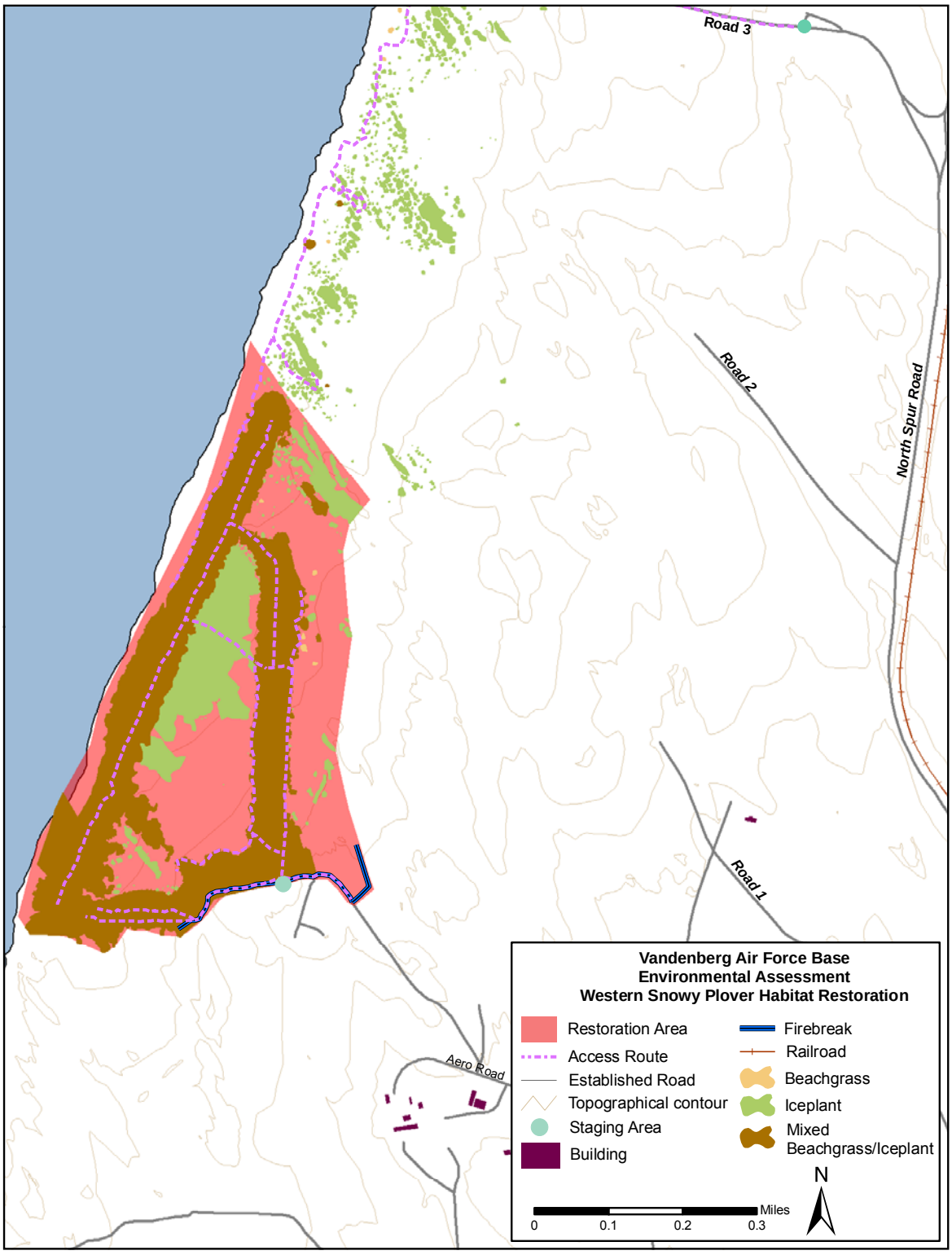

Figure 2-2. Area B project location.

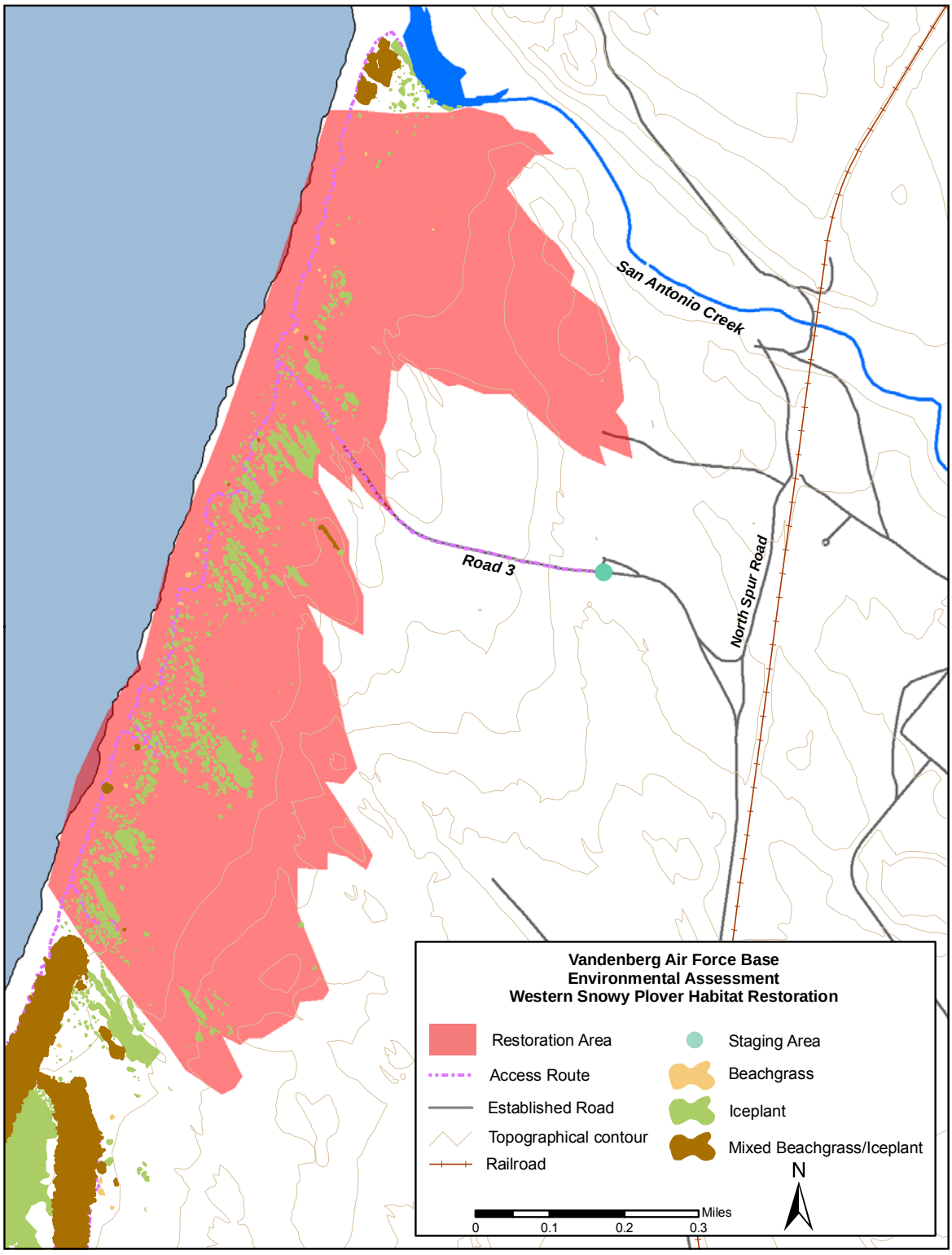

Figure 2-3. Area C project location.

treatment, it is possible that vegetation would stabilize the sand in this area, eventually precluding snowy plover nesting.

Access to this site would be on ATV, restricted to a designated sand access route beginning at Road 3 (Figure 2-3). A staging area would be located east of this access route.

As described in Section 2.1.1, fire treatment would be used to eliminate the dead aboveground biomass within large beach-grass infestations. Chemical treatments would be used to eradicate the iceplant, as well as isolated beachgrass infestations, and beachgrass sprouts following fire treatment. Revegetation would occur within Area C as described in Section 2.1.3.

2.1.4.4 Area D

Area D extends from the Santa Ynez River mouth southward approximately 0.62 mile to a point approximately 164 feet south of the public access trail at Surf Station (Figure 2-4). Area D meets selection Criteria 2 and Criteria 6 and comprises approximately 52 acres of snowy plover breeding habitat.

The infestation of beachgrass in this area covers approximately 22 acres. Iceplant occurs in isolated patches (less than 1 acre) throughout this section and in dense mats at the southern end. Acacia covers approximately 6 acres.

This project site would be accessed during periods of low tides through Wall Beach, when the sand bar at the Santa Ynez River is still in place. Equipment would access Area D by driving south below the high tide line from the Wall Beach parking lot, approximately 1 mile north of the project site. The Wall Beach parking lot would also serve as an equipment staging area for this site.

As described in Section 2.1.1.2, acacia would be mechanically removed. Fire treatment would be used to eliminate the aboveground biomass of large beachgrass infestations and acacia material. Chemical treatments would be used to eliminate iceplant, isolated beachgrass infestations, and beachgrass sprouts following fire treatment.

Approximately 28 acres of dune habitat within Area D would be contoured as described in Section 2.1.2. Following dune contouring, this area would be monitored and revegetated where the seed bank of all native and special status species is assumed to have been removed during treatment.

2.1.5 Post-Treatment Monitoring

Post-treatment monitoring and follow-up treatments would occur annually for a period of 5 years. The objective of post-treatment monitoring is to assess the effectiveness of initial treatment efforts, and provide guidance for follow-up treatment in areas exhibiting newly developed infestation. Post-treatment monitoring would focus on two aspects: resprouting and regeneration of targeted invasive species; and extent of native species cover and diversity. It is anticipated that annual, intensive monitoring, continued eradication efforts, and revegetation would be necessary throughout the post-treatment monitoring period.

Permanent monitoring plots would be established within each project area. Annual measurements of vegetative cover and species diversity would be taken. In addition, fixed-position photographic monitoring would be conducted to document overall vegetative cover and topographic changes.

2.1.6 Project Schedule and Personnel

Active restoration is anticipated to commence in 2008, outside the snowy plover breeding season (March 1 – September 30). Restoration activities are expected to occur for 5 months per year during a 5-year period, with 8-hour workdays and 5-day workweeks. Approximately two personnel would be required for each restoration activity. However, during application of fire treatment, up to 21 personnel may be present at the sites.

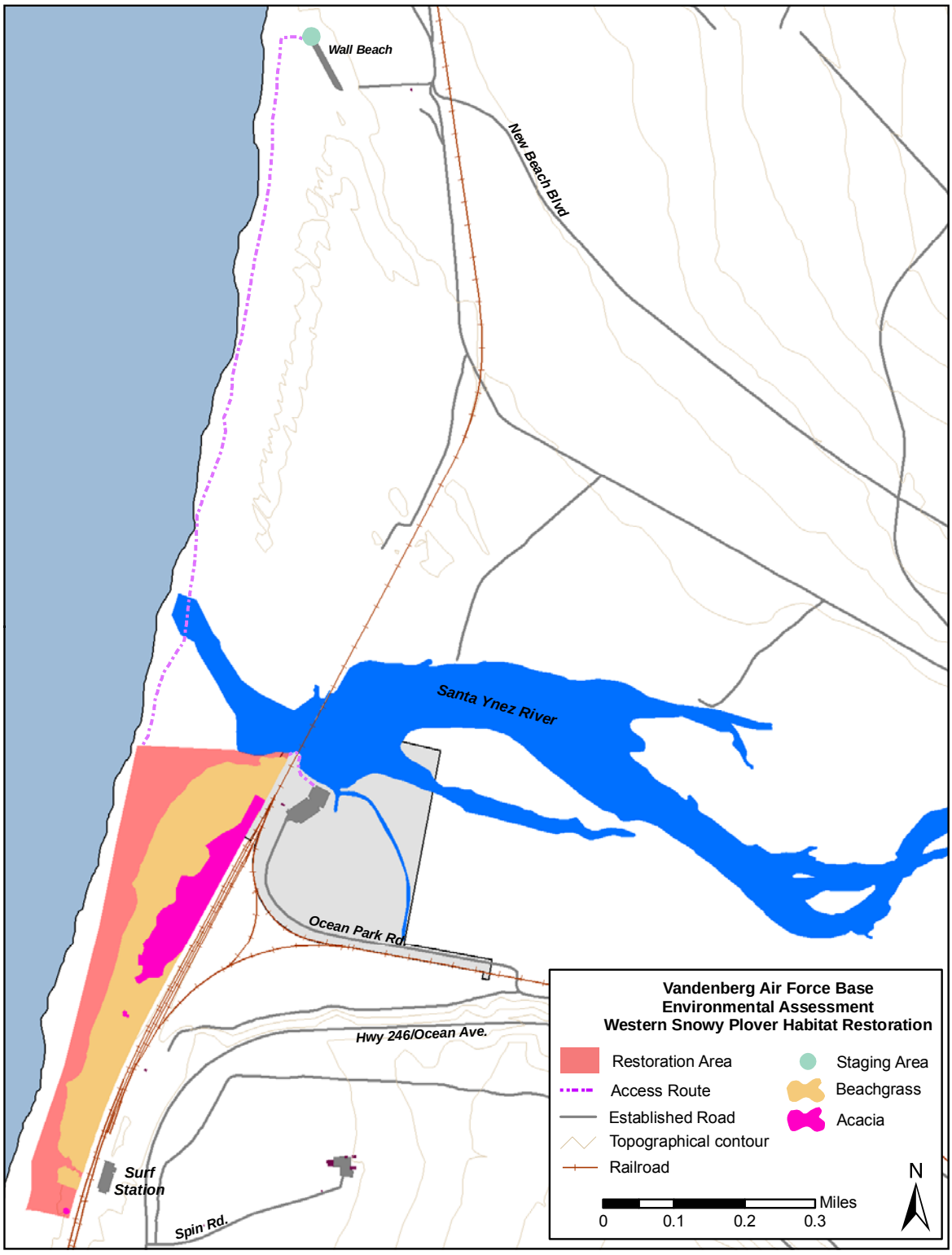

Figure 2-4. Area D project location.

2.1.7 Equipment Needs

Table 2-3 provides the estimated types and numbers of equipment that would be used for the proposed project. Although the exact type of equipment that would be used may varyslightly from these projections, these estimates provide a sound basis for analyzing related issues, such as air quality.

Table 2-3. Equipment needs for habitat restoration.

Equipment	Description
Polaris Ranger ATV	Herbicide Application
Honda GE-75 Pump	Herbicide Application
Rayco C87L Loader	Acacia mulching
Caterpillar D8N bulldozer	Dune Contouring and Firebreak Clearance
Yamaha Grizzly 660 ATV	Burn Ops
Stihl 460 Chainsaw	Burn Ops
Chevrolet K1500 Truck	ATV Transport
Dodge 3500 Utility Truck	Crew Truck
Ford F-450 Truck	Burn Ops ATV Transport
Ford F-850 Truck	Fire Crew Truck

2.2 Alternative B: No-Action Alternative

Under the No-Action Alternative, restoration of snowy plover habitat on VAFB would not take place. Current habitat quality and quantity would remain unchanged. Implementation of the No-Action Alternative would preclude satisfying federal requirements under the USFWS Biological Opinions (2001a, 2001b, 2003, 2005).

2.3 Alternative C

Under this Alternative, snowy plover habitat restoration on VAFB would entail all of the components described under the Proposed Action except that acacia would not be removed within Area D. Acacia was not addressed under the Restoration Plan (SRS 2005).

2.4 Alternatives Eliminated from Further Consideration

The Air Force has considered several methods for improving habitat for the snowy plover on VAFB. Habitat restoration methods considered are discussed in the Restoration Plan (SRS 2005).

The alternatives discussed in this section were included in the Restoration Plan (SRS 2005) but eliminated from further consideration for the reasons provided below.

2.4.1 Alternative D

Under this Alternative, invasive species within Area A would be manually removed by shoveling and hand pulling. The vegetation would be shaken/sifted to remove excess sand at the site, then trucked to the VAFB Sanitary Landfill. No contouring or revegetation of the dunes within Area A would occur under this Alternative.

A large archaeological site (CA-SBA-0710) has been recorded within the boundaries of Area A. Manual removal of invasive plant species may require excavation below historic grade levels; which has the potential to adversely affect buried cultural resources in this area. Revegetation would be required to immediately stabilize the sand after removal of non-native vegetation, and prevent exposure of this sensitive cultural resource area.

The existing footpath that connects the San Antonio Creek mouth with the northernmost part of the railway access occurs within habitat for the federally endangered El Segundo blue butterfly (*Euphilotes battoides allyni*). Seacliff buckwheat (*Eriogonum parvifolium*), host plant for this species, has been documented within this access route. Access to the site has the potential to result in adverse effects to this species.

Access to this site would be on foot or ATV via an existing footpath that connects the San Antonio Creek mouth with the northernmost part of a railway access road connecting Tangier Road with the San Antonio Creek railroad trestle. Road 3 would be used as a staging area. However, the footpath is unsuitable for ATV access to the site.

For these reasons, Alternative D was eliminated from further consideration.

2.4.2 Alternative E

Under this Alternative, mechanical removal would be used for the initial treatment of beachgrass within Area B. Herbicide application would be used to treat small patches of iceplant where native plant coverage is less than 40 percent, and manual removal would be used on iceplant patches where native species coverage is equal to or greater than 40 percent. Sprayed iceplant would be left in place, and the beachgrass screened to remove excess sand and trucked to the VAFB Sanitary Landfill, along with the manually removed iceplant. Once the beachgrass had been removed, the dunes would be contoured. Areas where heavy equipment was used would be revegetated.

Three archaeological sites have been recorded within the boundaries of Area B. Manual and mechanical removal methods, and dune contouring may require excavation below historic grade levels, which has the potential to adversely affect buried cultural resources in this area. For these reasons, Alternative E was eliminated from further consideration.

2.4.3 Alternative F

Under this Alternative, Area C would be treated by mannually removing isolated patches of beachgrass. Herbicide application would be used to treat small patches of iceplant where native plant coverage is less than 40 percent; and manual removal would be used on iceplant patches where native species coverage is equal to or greater than 40 percent. Manually removed vegetation would be shaken/sifted at the site to minimize excess sand, and then trucked to the VAFB Sanitary Landfill. No contouring or revegetation of the dunes within Area C would occur under this Alternative.

Five archaeological sites have been recorded within the boundaries of Area C. Manual removal may require excavation below historic grade levels, which has the potential to adversely affect buried cultural resources in this area. For these reasons, Alternative F was eliminated from further consideration.

2.4.4 Alternative G

Under this Alternative, treatment of invasive plant species throughout Area D would vary with dune structure, dune composition, and public use. All three treatment types; manual, chemical, and mechanical, would be employed in this area. Large areas densely infested with beachgrass would be mechanically removed with heavy equipment. Heavy equipment access to the project site would consist of constructing a temporary railroad crossing near the Ocean Beach County Park parking lot, creating a temporary crossing just to the north of Surf Station, accessing the beach through the current crossing at Surf Station, or a combination of the above. Revegetation would occur where heavy equipment was used. A staging area for fueling and maintenance would be located at the Ocean Beach County Park parking lot.

Chemical treatment would be used where dune structure does not need to be altered, and where iceplant coverage exceeds 40 percent of the vegetation. Following chemical treatment, dead vegetation would be manually removed in areas greater than 0.1 acre. Manual removal would be used in areas where native plant species coverage is equal to or greater than 40 percent of the total vegetative cover.

An unrecorded historical archaeological deposit was recently discovered within the project area. Mechanical and manual removal methods may require excavation below historic grade levels; which has the potential to adversely affect this historical deposit. Additionally, the creation of a

temporary access route for heavy equipment could not be coordinated with the Southern Pacific Railroad. For these reasons, Alternative G was eliminated from further consideration.

Chapter 3. Affected Environment

This chapter describes the existing environmental conditions near and within the proposed habitat restoration areas on VAFB that have the potential to be affected by the Proposed Action and Alternatives analyzed in this EA. The area considered for most resources was confined to the immediate area of the proposed habitat restoration activities. For some environmental resources, a wider regional area was used, as appropriate.

3.1 Air Quality

Air quality is described based upon the concentration of pollutants in the atmosphere. These concentrations are expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The type and amount of pollutants emitted into the atmosphere, together with the size and topography of the air basin and the prevailing meteorological conditions, determine air quality. Comparing the concentration to state and federal ambient air quality standards assists with determining the significance of any particular pollutant concentration. These standards represent the maximum allowable atmospheric concentrations that may occur while still providing protection for public health and safety with a reasonable margin of safety.

The Clean Air Act (CAA) required the U.S. Environmental Protection Agency (EPA) to establish ambient ceilings for certain criteria pollutants. Subsequently, the U.S. EPA promulgated regulations that set the National Ambient Air Quality Standards (NAAQS). NAAQS have been established for carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone (O_3), particulate matter 10 microns or less in diameter (PM_{10}), particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Of these seven criteria pollutants, five are primary pollutants; emitted directly from a source. $PM_{2.5}$ is both a primary and secondary pollutant, and O_3 is a secondary pollutant – i.e., not directly emitted, but formed from the reaction of nitrogen oxides (NO_X) and reactive organic compounds (ROCs). The NAAQS are presented in Table 3-1.

Under the California CAA, California established air quality standards for the state, known as the California Ambient Air Quality Standards (CAAQS). CAAQS are generally more stringent than the NAAQS and there are additional CAAQS for sulfates (SO_4), hydrogen sulfide (H_2S), vinyl chloride, and visibility-reducing particulate matter. The CAAQS are also presented in Table 3-1.

The area affected by the emissions from the Proposed Action includes VAFB and the surrounding portions of northern Santa Barbara County. For CO, NO_2, PM_{10}, and SO_2, the affected area is generally limited to a few miles downwind of the emission source, while for O_3 it can extend many miles downwind. Because the reaction between ROCs and NO_Xs usually occurs several hours after they are emitted, the maximum O_3 level can be many miles from the source; therefore, the area affected by O_3 and its precursors produced by VAFB, could include most of northern Santa Barbara County. In addition, O_3 and its precursors transported from other regions can combine with local emissions to produce high, local O_3 concentrations.

3.1.1 Regional Climate and Meteorology

The climate at VAFB can be characterized as cool and wet from November through April and warm and dry from May through October. The average annual rainfall is approximately 14.7 inches, most of which falls between November and May (unpub. data, 30 SW). Winds are usually light during the nighttime

Table 3-1. Ambient air quality standards.

Pollutant	Averaging Time	CAAQS(1,3)	NAAQS(2,3)	
			Primary(4)	Secondary(5)
Ozone	8-hour	0.07 ppm (137 μg/m^3)	0.08 ppm (157 μg/m^3)	Same as Primary
	1-hour	0.09 ppm (180 μg/m^3)	--	
Carbon Monoxide	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	None
	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide*	Annual Arithmetic Mean	0.03 ppm (56 μg/m^3))	0.053 ppm (100 μg/m^3)	Same as Primary
	1-hour	0.18 ppm (338 μg/m^3)	--	
Sulfur Dioxide	Annual Arithmetic Mean	--	0.03 ppm (80 μg/m^3)	--
	24-hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	--
	3-hour	--	--	0.5 ppm (1300 μg/m^3)
	1-hour	0.25 ppm (655 μg/m^3)	--	--
PM_{10}	Annual Arithmetic Mean	20 μg/m^3	--	Same as Primary
	24-hour	50 μg/m^3	150 μg/m^3	
$PM_{2.5}$	Annual Arithmetic Mean	12 μg/m^3	15 μg/m^3	Same as Primary
	24-hour	No State Standard	35 μg/m^3	
Sulfates	24-hour	25 μg/m^3	No Federal Standards	
Lead	30-day average	1.5 μg/m^3	--	--
	Calendar Quarter	--	1.5 μg/m^3	Same as Primary
Hydrogen Sulfide	1-hour	0.03 ppm (42 μg/m^3)	No Federal Standards	
Vinyl Chloride	24-hour	0.01 ppm (26 μg/m^3)	No Federal Standards	
Visibility Reducing Particles	8-hour	Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more due to particles when relative humidity <70%.	No Federal Standards	

NOTES:

*The Nitrogen Dioxide ambient air quality standard was amended on February 22, 2007, to lower the 1-hr standard to 0.18 ppm and establish a new annual standard of 0.03 ppm. These changes become effective after regulatory changes are submitted and approved by the Office of Administrative Law, expected in 2007.

(1) California Standards for ozone, carbon monoxide, sulfur dioxide (1- & 24-hour), nitrogen dioxide, PM_{10}, $PM_{2.5,}$ and visibility reducing particles are not to be exceeded. Sulfate, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

(2) National Standards, (other than ozone, particulate matter, and those based upon annual averages or average arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three-years, is equal to or less than the standard. For PM_{10}, the 24-hours standard is attained when 99% of the daily concentrations, averaged over three years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hours standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or less than the standard.

(3) Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature and pressure of 25 degrees Celsius (^{O}C) and 760-mm Hg, respectively. Most measurements of air quality are to be corrected the reference temperature of 25^{O}C and reference pressure of 760-mm Hg; ppm in this table refers to ppm by volume or micromoles of pollutant per mole of gas.

(4) National Primary Standards: The level of air quality necessary, with an adequate margin of safety to protect the public health.

(5) National Secondary Standards: The level of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

ppm = parts per million; % = percent; μg/m^3 = micrograms per cubic meter

hours, reaching moderate speeds of approximately 12 miles per hour by the afternoon. Winds are most often northwesterly on North Base and north to northeasterly on South Base. The strongest winds are associated with rainy season storms.

VAFB is subject to early morning and afternoon temperature inversions about 96 and 87 percent of the time, respectively. In an inversion, air temperature rises with increasing altitude, which confines the surface air and prevents it from rising (VAFB *In Progress*).

This restricts the vertical dispersion of pollutants and, therefore, increases local pollutant concentrations. Pollutants are "trapped" under an inversion layer until either solar radiation produces enough heat to lift the layer or strong surface winds disperse the pollutants. In general, these conditions occur most frequently during the nighttime and early morning hours.

3.1.2 Existing Air Quality

The EPA classifies air quality within each air quality control region with regard to its attainment of NAAQS. The California Air Resources Board (CARB) does the same for CAAQS. An area with air quality better than state or federal ambient air quality standards for a specific pollutant is designated as attainment for that pollutant. Any area not meeting those standards is classified as non-attainment. Santa Barbara County is in attainment or unclassified for all the ambient air quality standards except for the state standard for PM_{10} and O_3.

The estimated emissions for Santa Barbara County and VAFB are presented in Table 3-2 and Table 3-3. In Table 3-2, the Santa Barbara County emissions are 2002 daily planning emissions taken from the 2007 Santa Barbara County Air Pollution Control District (SBCAPCD) Clean Air Plan, while the VAFB emissions are annual emissions taken from the 2001 Comprehensive Emission Inventory Draft Report.

Table 3-2. Existing emissions.

Source	2002 Emissions			
	Annual (Tons/Year)		Planning Day (Tons/Day)	
	NO_x	ROC	NO_x	ROC
Santa Barbara County	*16,155.94*	*43,439.57*	*41.2055*	*40.8432*
Stationary Sources	2,468.61	3,210.78	6.1160	9.3072
Area-Wide Sources	412.42	3,731.71	0.6326	9.9218
Mobile Sources	12,412.43	7,888.88	33.9613	21.6142
Natural Sources		28,608.20		882.4800
Outer Continental Shelf Sources	*14,324.89*	*3,499.34*	*39.2558*	*3.8761*
Stationary Sources	305.16	425.88	0.8361	1.1667
Mobile Sources	14,019.73	994.56	38.4197	2.7094
Natural Sources		2,078.90		
Total	**30,480.83**	**46,938.91**	**80.4613**	**44.7193**
VAFB Annual	***1,134***	***229***	***ND***	***ND***

SOURCE: 2007 Clean Air Plan, Santa Barbara County's plan to maintain the federal 8-hour ozone standard and attain the state 1-hour ozone standard, August 2007.

Table 3-3. VAFB annual emissions (tons) in 2006.

	CO	NO_x	PM_{10}	SO_x	ROC
Mobile					
On-Road	402.75	160.71	2.08	NE	46.06
Off-Road	575.78	20.02	2.34	0.91	20.60
Aircraft/Launch Vehicles	97.45	14.69	6.87	1.60	37.19
Permitted Sources	NE	1.35	0.48	0.42	3.30
Exempt Source	NE	19.63	NE	NE	32.96
Total	**1,075.98**	**216.40**	**11.77**	**2.93**	**140.11**

NE = Not estimated
SOURCE: VAFB, 30 CES/CEV, unpublished data

On January 24, 2007, President Bush issued EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. One of the main requirements established under this EO is the reduction of greenhouse gases through a reduction in energy intensity of 3 percent per year or 30 percent by the end of fiscal year 2015.

3.2 Biological Resources

Federal agencies are required by Section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 *et seq.*), to assess the effect of any project on federally listed threatened and endangered species. Under Section 7, consultation with the USFWS and the National Oceanic and Atmospheric Administration National Marine Fisheries Service is required for federal projects if such actions could directly or indirectly affect listed species or destroy or adversely modify critical habitat.

It is also Air Force policy to consider listed and special status species recognized by state agencies when evaluating impacts of a project. Impacts to biological resources would occur if special status species (i.e., endangered, threatened, rare, or candidate) or their habitats, as designated by federal and state agencies, would be directly or indirectly affected by project-related activities. These impacts can be short- or long-term impacts, such as short-term impacts from noise and dust during construction, and long-term impacts from the loss of vegetation and, consequently, loss of habitat for wildlife.

Biological resources on VAFB are abundant and diverse compared to other areas of California because VAFB is within an ecological transition zone where the northern and southern ranges of many species overlap, and because the majority of the land within Base boundaries has remained undeveloped.

3.2.1 Methodology

Potential occurrence of plant and wildlife species, including special status species, was determined based on suitability of habitat and known occurrence based on literature searches and other existing documentation.

Sources used to determine potential occurrence include literature and maps of natural resources present at VAFB and existing local and regional references (VAFB *In Progress*; California Department of Fish and Game [CDFG] 1999, 2001, 2007a, 2007b; Christopher 1996, 2002; Coulombe and Mahrdt 1976; Holmgren and Collins 1999; Keil and Holland 1998; Lehman 1994). Existing special status species survey and location maps (SRS 2006, 2007, ManTech SRS Technologies [MSRS] 2008) were superimposed over the project area, via Geographic Information System (GIS) layers, and intersecting occupied habitat was documented and/or reviewed. The scope of the survey includes vegetation and wildlife resources, as well as waters of the U.S. and wetlands.

3.2.2 Vegetation Types and Invasive Plant Species

Three distinct vegetation types were identified within the proposed restoration areas: coastal strand and foredunes, coastal dune scrub, and ruderal. No sensitive vegetation types occur within the proposed project area.

The Proposed Action and Alternatives would occur primarily in the coastal strand and foredunes. Some activities would occur where this vegetation type grades into coastal dune scrub. Vegetation types are described in detail below. Where suitable, nomenclature follows Holland (1986). Plant species nomenclature follows Hickman (1993).

Coastal Strand and Foredunes

Coastal strand vegetation often is described as a combination of beach and active dune types. Plants growing on active primary dunes tend to collect sand and form

vegetated hummocks. Coastal strand develops on open sand that has been blown above the high tide level allowing terrestrial plants in this area to colonize the sand surface. Species diversity in these communities is very low and only the most salt-tolerant species are able to grow immediately adjacent to the high-tide line and adjacent beach. During storms, saltwater may wash over plants that survive (Keil and Holland 1998). Plant species of the coastal strand are adapted to disruption by the natural forces of wind and water, as active dunes are dynamic habitats. They are sensitive to unnatural disturbances such as trampling and clearing, and are slow to recolonize when disturbed.

This vegetation type occurs along a continuous, narrow corridor immediately inland from the ocean, and is characterized by sparse and low-growing suffrutescent or succulent species such as sand verbenas (*Abronia latifolia, A. maritima, A. umbellata*), beach-bur (*Ambrosia chamissonis*), and sea rocket (*Cakile maritima*) (Keil and Holland 1998).

On VAFB, coastal strand occurs from the southern edge of the rocky cliffs at Lion's Head to the rocky outcrops north of Purisima Point on North Base, and from the northernmost point of Wall Beach to the rocky outcrops north of Point Pedernales on South Base.

The sandy beaches and dunes on VAFB are unique in being relatively protected from development and heavy recreational use. Coastal strand is the most common vegetation type within snowy plover breeding habitat on VAFB. In addition, this vegetation type provides habitat for a number of special interest plants and animals, primarily in the active dunes, including the federal and state California least tern (*Sterna antillarum browni*), and endemic plant species such as surf thistle (*Cirsium rhothophilum*), beach spectacle pod (*Dithyrea maritima*), and dunedelion (*Malacothrix incana*).

Coastal Dune Scrub

This vegetation type is found on sandy backdunes stabilized by vegetation cover, behind foredunes, and in transitional dune areas. Coastal dune scrub has relatively dense and continuous plant cover, composed of scattered shrubs, subshrubs, and herbs, dominated by goldenbush (*Ericameria ericoides*), California sagebrush (*Artemisia californica*), and bush lupine (*Lupinus chamissonis*). Wind erosion can occur when vegetation cover is disturbed or removed. Sand dune encroachment is a natural process, although it may be a problem on man-made features.

Coastal dune scrub occurs along most of the western coast of VAFB. On South Base, it occurs as a relatively narrow strip extending a few hundred yards inland and grading into coastal sage scrub or grassland. On North Base, it is found along a wider section of the coast extending several miles inland in some areas.

In California, this vegetation type may be best represented on VAFB due to extensive habitat degradation and loss elsewhere (VAFB *In Progress*). Unique dune swale or slack wetlands occur in the stabilized sand dunes, providing habitat for many plant and animal species including many endemic species. Important endemic plants in this community include San Luis Obispo monardella (*Monardella frutescens*), Blochman's leafy daisy (*Erigeron blochmaniae*), and black-flowered figwort (*Scrophularia atrata*). Important wildlife species include loggerhead shrike (*Lanius ludovicianus*), California horned lizard (*Phrynosoma coronatum frontale*), and silvery legless lizard (*Anniella pulchra pulchra*).

Ruderal

Ruderal vegetation typically occurs at roadsides, waste areas, and other sites continuously disturbed by activities such as traffic, road construction, and road maintenance. Annual, and usually non-native forbs and grasses, that can rapidly invade disturbed areas dominate ruderal vegetation

types. Plant species commonly found at these sites include wild oats (*Avena* spp.), soft chess brome (*Bromus hordeaceus*), veldt grass (*Ehrharta calycina*), fescues (*Vulpia* spp.), black mustard (*Brassica nigra*), wild radish (*Raphanus sativus*), plantain (*Plantago erecta*), and coyote brush (*Baccharis pilularis*). Gaviota tarplant (*Deinandra increscens* ssp. *villosa*), a federal and state endangered species, is common within the ruderal vegetation on VAFB.

Within the project areas for the Proposed Action, this vegetation type occupies the gravel road base of Road 3, and the 1- to 3-foot margin bordering the roadside of North Spur Road (see Figure 2-1 in Chapter 2).

Invasive Plant Species

The terms "exotic", "non-native", "non-indigenous", and "alien" all refer to species introduced either intentionally or accidentally into a region where they do not naturally occur. An invasive plant species, for the purposes of this EA, is defined as one of these species that is not native to the area, does not have a natural control to limit its reproduction and spread, and tends to out-compete or over cover regional native species, sometimes to the point of exclusion.

The quality and extent of snowy plover breeding habitat on VAFB is being degraded by the invasion of non-native plant species. Additionally, these invasive species often degrade habitat by excluding native plant species as they spread. The two most invasive plant species in snowy plover breeding habitat on VAFB are beachgrass and iceplant.

Beachgrass was planted on VAFB near Purisima Point as part of an erosion control program in the 1950s (Schmalzer and Hinkle 1987). This species currently is scattered along most of the coast of VAFB and is widespread within the proposed project areas. Extensive ridges have formed within Area B, apparently as a result of sand accumulation along lines of existing drift fence.

Iceplant was planted on VAFB during the 1940s and 1950s. This species currently occupies thousands of acres on Base (VAFB *In Progress*), scattered throughout many vegetation types. Iceplant is widespread within the proposed project areas.

Acacia was planted on VAFB as an erosion control measure in the dunes west of the Lompoc Terrace and north of Honda Creek, where it has since naturalized (Keil and Holland 1998). It also occurs in patches along the Southern Pacific Railroad right-of-way, and on ridges above Honda Canyon on South Base. Additional stands of acacia occur on ridges above Honda Canyon, and along the headwaters of Lake Canyon. Within the project areas for the Proposed Action, acacia occupies approximately 6 acres within Area D (see Figure 2-4 in Chapter 2).

3.2.3 Wildlife Species

Coastal communities support numerous avian species, terrestrial mammals, reptiles, amphibians, and invertebrates. Marine mammals are also known to occasionally haul out on the sandy beaches of coastal communities.

Species commonly occurring, or expected to occur, within the proposed project area include western gull (*Larus heermanni*), willet (*Catoptrophorus semipalmatus*), sanderling (*Calidris alba*), deer mouse (*Peromyscus maniculatus*), agile kangaroo rat (*Dipodomys agilis*), California pocket mouse (*Perognathus californicus*), California mouse (*Peromyscus californicus*), ornate shrew (*Sorex ornatus*), Trowbridge shrew (*Sorex trowbridgii*), Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), western harvest mouse (*Reithrodontomys megalotis*), Virginia opossum (*Didelphis virginiana*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), mule deer (*Odocoileus hemionus*), bobcat (*Felis rufus*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), western fence lizard (*Sceloporus occidentalis*), southern alligator lizard (*Elgaria multicarinata*), western terrestrial garter snake (*Thamnophis*

elegans), and ensatina (*Ensatina eschscholtzii*).

3.2.4 Special Status Species

A number of federal and state special status species occur within the proposed project areas. For purposes of this assessment, all federal and state threatened and endangered species, and other federal special status species are identified in Table 3-4. Only federal and state threatened and endangered species are described in detail in this section; however, all special status species are considered in the analysis of impacts in Chapter 4. Special status species with potential to occur, but not documented as of the present time, are not included in the following discussion.

Three federal and/or state threatened and endangered plant species are known to occur within the proposed project areas: surf thistle, beach spectacle pod, and Gaviota tarplant. Salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*), a federal and state endangered species, was historically reported in the Santa Ynez River salt marsh area (Coulombe and Cooper 1976, Schmalzer et al. 1988). Currently, no known locations of this species occur on VAFB; therefore, salt marsh bird's beak is excluded from further discussion.

In addition, three federal and/or state endangered wildlife species occur within the proposed project areas: El Segundo blue butterfly, California brown pelican (*Pelecanus occidentalis californicus*), and California least tern. Federally threatened wildlife species include California red-legged frog (*Rana aurora draytonii*) and snowy plover.

The American peregrine falcon (*Falco peregrinus anatum*) was delisted from the federal endangered species list in 1999 but remains on the state endangered species list. This species is most frequently observed within the proposed project areas either during overflights or perched on elevated posts, wood piles, etc. Avian species commonly move away from areas of human disturbance. Therefore, this species was excluded from further discussion.

Marine mammals including Pacific harbor seal (*Phoca vitulina richardii*), California sea lion (*Zalophus californianus*), and northern elephant seal (*Mirounga angustirostris*), protected under the Marine Mammal Protection Act of 1972, haul-out on rocky outcrops outside of snowy plover breeding areas but occasionally haul-out on sandy beaches within the habitat. The federally threatened southern sea otter (*Enhydra lutris nereis*) is frequently observed offshore along the VAFB coastline, and a resident breeding colony is present in the kelp beds near shore to Purisima Point. Federal actions associated with snowy plover habitat restoration would not occur near any of the known marine mammal haul-out areas. Since the Proposed Action would not affect marine mammals, they are excluded from further discussion.

El Segundo Blue Butterfly

El Segundo blue butterfly is endemic to coastal sand dunes that support suitable conditions for its host plant, seacliff buckwheat, the early life stages, larval food plants, adult nectar sources, and adult feeding, perching, and courtship areas.

El Segundo blue butterflies emerge during summer with the opening of the flowers of seacliff buckwheat, which is used for larval food, adult nectaring, mate location, copulation, and oviposition. The host plant also provides a layer of litter beneath the plant where pupation typically occurs. The adult life of these butterflies is relatively short, only a few days between June and September, during which time they mate and lay eggs (Arnold 1983). The eggs hatch within a week or so of their deposition. The larvae feed on the flower heads of the host plant for approximately 1 month before they enter the pupal stage (Mattoni 1992).

Seacliff buckwheat occurs within Area B and the coastal dune scrub community bordering the project areas on North Base and the Road 3 and SLC-10 access routes on North Base.

Table 3-4. Special status plant and wildlife species that occur within the proposed habitat restoration areas on VAFB.

Scientific Name **Common Name**	**Status**		**Occurrence**	**Habitat**	**Comments**
	USFWS[1]	**CDFG[2]**			
Plants					
Cirsium rhothophilum Surf thistle		ST	Documented	Coastal strand	Blooms April – June
Dithyrea maritima Beach spectacle pod		ST	Documented	Coastal strand	Blooms April – May
Deinandra increscens ssp. *villosa* Gaviota tarplant	FE	SE	Documented	Grassland, ruderal	Blooms June – September
Amphibians					
Rana draytonii California red-legged frog	FT	CSC	Documented	Perennial ponds, streams	Breeds February – April
Invertebrates					
Euphilotes battoides allyni El Segundo blue butterfly	FE		Documented	Coastal sand dunes	Adult flight period June – September
Birds					
Pelecanus occidentalis californicus California brown pelican	FE	SE	Documented	Near-shore waters, coastal bluffs, rock outcrops, occasionally at river mouths	Only forage and winter on VAFB
Falco peregrinus anatum American peregrine falcon	FD	SE	Documented	Forage over all open habitats, breeds on cliffs	Breeds February – July. On beaches, most frequently observed roosting on high perch and fly-overs.
Charadrius alexandrinus nivosus Western snowy plover	FT	CSC	Documented	Coastal sandy beaches, dunes	Breeds and winters on VAFB Breeds March – September
Sterna antillarum browni California least tern	FE	SE	Documented	Coastal sandy beaches, dunes	Breeds April – August Does not winter on VAFB
Numenius phaeopus Whimbrel	BCC	CSC	Documented	Coastal sandy beaches, dunes	Only forage and winter on VAFB
Numenius americanus Long-billed curlew	BCC		Documented	Coastal sandy beaches, dunes	Only forage and winter on VAFB
Limosa fedoa Marbled godwit	BCC		Documented	Coastal sandy beaches, dunes	Only forage and winter on VAFB
Athene cunicularia hypugaea Western burrowing owl	BCC	CSC	Documented	Open scrub	Breeds April – June At present, only known to winter on VAFB
Lanius ludovicianus Loggerhead shrike	BCC	CSC	Documented	Forage over all open habitats, breeds in shrubs or trees	Breeds March – August

NOTES:
1 FE = Federal Endangered Species FT = Federal Threatened Species FD = Federal Delisted Species
BCC = Federal Bird of Conservation Concern
2 SE = State Endangered Species ST = State Threatened Species CSC = California Species of Concern

California Red-legged Frog

This highly aquatic amphibian inhabits quiet pools of streams, marshes, and occasionally ponds, where it prefers shorelines with extensive vegetation. It is active year-round in coastal areas, and can be found in upland areas during the winter and early spring. Breeding occurs from November to mid-April.

California red-legged frogs occur in nearly all permanent streams and ponds on VAFB (Christopher 1996). California red-legged frogs occur in dune swale wetlands within

snowy plover breeding habitat. Because none of these wetlands occur within areas under consideration for habitat restoration under any of the alternatives considered in this assessment, it is excluded from further discussion.

Critical habitat for the California red-legged frog was designated on March 13, 2001. VAFB was excluded from critical habitat designation under section 4(b)(2) of the federal ESA. As a result, the proposed project is not in critical habitat.

Gaviota Tarplant

A member of the Aster family, Gaviota tarplant is a gray-green, hairy, summer flowering annual with stems branching near the base. This plant is most often associated with grasses, and on occasion, with coastal shrubs such as *Baccharis* and *Isocoma*. Gaviota tarplant is endemic to Santa Barbara County and there are several locations of this species on VAFB. While most locations are coastal, some extend inland. Gaviota tarplant has been documented in the ruderal community located along the roadsides of North Spur Road and within Road 3, both of which would be equipment and personnel access routes to project areas on North Base.

The USFWS designated critical habitat for Gaviota tarplant on November 7, 2002. VAFB was excluded from this designation under section 4(b)(2) of the federal ESA. As a result, the proposed project is not in critical habitat.

Surf Thistle

Surf thistle is a short lived, low growing perennial which flowers between April and June. This species is endemic to the ocean bluffs and ocean-facing foredunes along the coast of California where it is confined to scattered populations from Point Conception to Pismo Beach in southern San Luis Obispo County. In Santa Barbara County it occurs in stabilized dunes at Point Conception and Point Arguello, and sporadically in coastal strand and foredune communities at VAFB. Surf thistle has been documented at various locations throughout the restoration areas.

Beach Spectacle Pod

Beach spectacle pod is a low growing, perennial herb which flowers between April and May. This species occurs in active sand dunes and foredunes, often where the sand is moving, such as on the margins of blowouts. This species occurs sporadically along the coast from northern Baja California to San Luis Obispo County and on two of the California Channel Islands. In Santa Barbara County it occurs on sandy places near Mussel Rock and Point Sal at elevations less than 50 meters, and sporadically in coastal strand and foredune communities on VAFB. Beach spectacle pod has been documented at various locations throughout the project areas.

California Brown Pelican

California brown pelicans roost on the rocky cliffs and coastal bluffs of VAFB and feed in offshore waters and coastal lagoons. Peak numbers occur from June through January as brown pelicans migrate north from Mexico. Anacapa Island, located in the Santa Barbara Channel, is the nearest known breeding site. This species is frequently seen at many locations along the coastline of VAFB, including near Point Sal, near the mouths of Shuman Creek, San Antonio Creek, the Santa Ynez River, Purisima Point, and the Boat House breakwater. Roosting brown pelicans have the potential to occur throughout the coastal strand within the project areas.

On February 20, 2008 the USFWS published a proposed rule to de-list California brown pelicans (USFWS 2008).

Western Snowy Plover

Snowy plovers breed and winter on the foredunes along the coast of VAFB, from near Point Sal to Purisima Point, and along beaches north and south of the Santa Ynez River mouth. VAFB has consistently supported one of the largest populations of breeding snowy plovers along the west coast

of the U.S. (Page and Persons 1995). In 2004, VAFB supported an estimated 22 percent of California's breeding population. Snowy plover breeding beaches on VAFB are closed to recreational access from March 1 to September 30.

On December 7, 1999, the USFWS published a Final Rule for Designation of Critical Habitat for the Pacific Coast Population of the western snowy plover (64 FR 68508). A revised Final Rule published on September 29, 2005 (70 FR 56970) excludes snowy plover breeding habitat on VAFB from critical habitat designation under section 4(b)(2) of the federal ESA. In addition, the USFWS published a Recovery Plan for the snowy plover in October 2007 (USFWS 2007a)

California Least Tern

The California least tern is a migratory bird species that breeds in coastal foredunes. This species winters in Latin America and is typically not present on VAFB between September and mid-April.

At present, the only breeding colony on VAFB is located near Purisima Point. In 2003, three nests were established approximately 2 miles north of Purisima Point at the south end of San Antonio Beach within Area C. This is the only time since 1998 least terns have been documented breeding at a location outside of the colony at Purisima Point. Least terns use other areas on VAFB for foraging and roosting, including the Santa Ynez River mouth, and that of San Antonio Creek and Shuman Creek. Least tern breeding sites and other potential breeding and foraging sites on VAFB are closed to recreational access from March 1 to September 30.

Activities associated with the Proposed Action and Alternatives would occur outside of the least tern breeding season (April through August). Least terns are not expected to be present during project implementation; therefore, this species was excluded from further discussion.

3.2.5 Waters of the United States and Wetlands

For the wetland hydrology criterion to be met a site must be inundated or saturated or exhibit features that show the area was inundated or saturated for the required period of time (i.e., 45 days).

Several waterways, identified as waters of the U.S., occur within the restoration areas. San Antonio Creek, with adjacent wetlands on either side dominated by willow riparian woodland, occurs on North Beaches. In addition, several small isolated dune swale wetlands are present on North Beaches. The Santa Ynez River and associated wetlands dominated by willow riparian woodland is present on South Beaches.

Although waters of the U.S. and wetlands occur within the proposed restoration areas, actions evaluated in this assessment would avoid encroaching into these sensitive habitats. Therefore, no further discussion is presented on this subject area.

3.3 Cultural Resources

Criteria used to evaluate the significance of cultural resources and to assess potential adverse project effects are set forth in the National Historic Preservation Act (NHPA) of 1966 (as amended). Associated implementing regulations include 36 CFR 60 and 800.

A synopsis of the prehistory and history of the region is included in Appendix C.

An archaeological record search was completed at the California Historical Resources Information System Central Coast Information Center, University of California, Santa Barbara (UCSB), and the 30th Civil Engineer Squadron, Environmental Flight, Cultural Resources Section (30 CES/CEVNC) at VAFB. Background research included a review of archaeological literature, archaeological base maps, and cultural resource records. Information was collected

from previous inventories and archaeological studies within 0.5 mile, and known sites within 0.25 mile, of the project areas. Maps consulted at 30 CES/CEVNC include the VAFB C-1 series (46 map set), Base Comprehensive Plan GIS, and U.S. Geological Survey (USGS) topographic maps. Aerial photographs at the UCSB Map and Imagery Library were also consulted.

3.3.1 Cultural Resource Studies

Record search results indicate that 26 surveys or other cultural research studies have been conducted within 0.5 mile of the proposed restoration areas (Table 3-5).

All of the areas proposed for habitat restoration were inventoried for archaeological resources during the Base-wide survey (Carbone and Mason 1998). In addition, seven studies have taken place within the proposed restoration areas. A survey for seismic lines for Union Oil (WESTEC 1981) passed through Areas B and C. Three additional linear surveys (Erlandson 1984; King et al. 1985; and Peterson et al. 1984) were completed through Area D. In 2002, all previously recorded sites in the project vicinity were examined as part of an ongoing assessment of archaeological site conditions (Coleman and Lebow 2004). In 2003 through 2004, Applied EarthWorks surveyed the entire VAFB coastline (Lebow and Ryan 2006), an effort that included all four restoration areas. In 2007, an archaeological study was completed specifically for the proposed restoration project (Peterson et al. 2008).

Table 3-5. Previous cultural resource studies within 0.5 mile of the proposed restoration areas.

References (in chronological order)	VAFB Reference Number	UCSB Reference Number
Ruth 1967	VAFBR-RUTH03	
Spanne and Glassow 1974	VAFB-1974-01	
Spanne 1974	VAFB-1974-02	
Glassow et al. 1976	VAFB-1976-01	
WESTEC Services, Inc. 1981*	VAFB-1981-04	
Glassow et al. 1981	VAFB-1981-10	V-16
WESTEC Services, Inc. 1982	VAFB-1982-10	V-17
Erlandson 1984*	VAFB-1984-11	V-40
Gibson 1984	VAFB-1984-22	
Brown 1984	VAFB-1984-23	
Peterson et al. 1984*	VAFB-1984-31	E-282
Martin Marietta 1985	VAFB-1985-09	
Gibson 1985b	VAFB-1985-10	
Gibson 1985a	VAFB-1985-15	
King et al. 1985*	VAFB-1985-25	
Tetra Tech 1988	VAFB-1988-14	
Jaffke 1990	VAFB-1990-07	
Glassow 1990	VAFB-1990-21	
Clark 1997	VAFB-1997-01	
Carbone and Mason 1998*	VAFB-1998-03	
Lebow 2000	VAFB-2000-12	
Gibson and Parsons 2002	VAFB-2002-02	
Lebow 2004	VAFB-2004-01	
Coleman and Lebow 2004*	—	
Lebow and Ryan 2006*	VAFB-2006-08	
Peterson et al. 2008*	—	

*Within the project archaeological study area.

3.3.2 Recorded Cultural Resources

Twenty-two previously recorded archaeological sites and eight isolated artifacts are recorded within 0.25 mile of the proposed restoration areas. Fifteen cultural resources are immediately adjacent to, or partially within, the habitat restoration areas; including SLC-10, a National Historic Landmark (Table 3-6Table 3-6). Other resources include 12 prehistoric and two historical archaeological resources that have not been evaluated for eligibility to the NRHP. For purposes of this project only, the 14 unevaluated resources are assumed eligible for the NRHP and a plan was developed to avoid all 15 cultural resources (Peterson et al. 2008). These resources are described by restoration area below.

Table 3-6. Previously recorded resources within and adjacent to the archaeological study areas.

Resource	NRHP Status
CA-SBA-0709	Unevaluated
CA-SBA-0710	Unevaluated
CA-SBA-0744	Unevaluated
CA-SBA-0900	Unevaluated
CA-SBA-0901	Unevaluated
CA-SBA-0902/0903	Unevaluated
CA-SBA-0904	Unevaluated
CA-SBA-1754	Unevaluated
CA-SBA-3275	Unevaluated
CA-SBA-3277	Unevaluated
CA-SBA-3278	Unevaluated
CA-SBA-3348	Unevaluated
CA-SBA-3544H	Unevaluated
CA-SBA-3833H	Unevaluated
SLC-10	National Historic Landmark (1986)

Area A

Area A is associated with CA-SBA-710, which is described as a large dune area with numerous small clusters of chipping detritus, shell, and bird bone. Cultural material densities within the clusters range from low to high.

Area B

Area B is associated with sites CA-SBA-900, -904, -1754, -3275, -3348 and Feature 42-P-040929. Area B also borders SLC-10, the only National Historic Landmark on VAFB.

Feature 42-P-040929 is a series of sand ridges that are the focus of the restoration efforts in Area B. The sand ridges and associated beachgrass show up distinctly in a modern aerial photograph as a large, roughly triangular shaped feature resembling the number “4”. However, aerial photographs taken in 1938 and 1954 show nothing in this area, while a 1960 aerial photograph shows a series of fences that correspond to the current configuration of the sand ridges. These fences remain intact in many locations. Clearly, the sand ridges that are now covered with beachgrass postdate 1960. A 1977 VAFB map of Airfield Lighting, Communications and Navaid Systems shows a combination of fences, buried cables, and roads that appear in the same configuration as the current sand ridges. It also shows the centerline of the landing approach zone for the airport passing through the northern tip of Area B. An earlier (1966) Master Plan of the Sanitary Sewerage System shows a series of, what appear to be, fences in the exact position of the modern sand ridges. However, they are not identified as to function. Currently, the inland edges of the linear dune ridges are marked by remnants of drift fences made of wire and vertical slats. It appears these fences were installed to protect the access roads for the airport systems. Some may also have been attempts to keep sand out of the area of the SLC-10 facility. These fences and associated ridges have been recorded as an isolated historical feature relating to the early use of VAFB.

CA-SBA-900 was recorded as a low- to moderate-density shell scatter with a low-density scatter of chipping waste, bird bone, and fire-altered rock. Archaeological material was noted in three surface deposits.

CA-SBA-904 was recorded as a low-density deposit of chipping waste and marine shell

along the beach, with areas of high-density chert debitage and fire-cracked cobbles.

CA-SBA-1754 was recorded as a small, sparse flake scatter isolated in a large depression in a barren dune.

CA-SBA-3275 was recorded as a sparse scatter of lithic debris, marine shell, and bone. Two concentrations of cultural materials, one of fire-altered rock and cobbles and another of marine shell, were identified.

CA-SBA-3348 was recorded as a sparse lithic scatter covering an area of only 10 by 15 meters. A subsequent inspection noted that a road passing through the site had not been recognized by the original recorder and that the chert was all within the shale road fill. It was considered possible that the "cultural material" is, in fact, the product of road construction (Coleman and Lebow 2004).

Area B is located immediately west of SLC-10, which became a National Historic Landmark in 1986. Access to the restoration area would be via a paved road through SLC-10. A contingency firebreak, in case the primary firebreak is breached, would be constructed outside the perimeter fence around SLC-10, outside the boundary of the National Historic Landmark. This firebreak would not be constructed in advance, only in the event of an emergency. Fire engines and hand crews would be standing by, in case the primary and contingency firebreaks are both breached, and the SLC-10 facilities are threatened.

Area C

Area C is made up of many small patches of vegetation within a large sand sheet. It is associated with ten archaeological sites: CA-SBA-709 -710, 774, 900, -901, -902/903, -3277, -3278, 3833H and -3917. CA-SBA-710 is described above, under Area A. CA-SBA-900 is described above, under Area B.

CA-SBA-709 was described as a small scatter of marine shell near the top of a large active dune field.

CA-SBA-774 was recorded as a low-density scatter of chipping detritus and a small amount of marine shell in a sand blow on the side of a dune.

CA-SBA-901 was described as a low-density shell scatter with a low- to moderate-density scatter of lithic debitage, hammerstones, and cores. Five artifact concentrations were noted.

CA-SBA-902/903 was originally recorded as two sites. Their boundaries were expanded in 1995 during the basewide survey (Carbone and Mason 1998), and combined in 2004 during the coastal survey (Lebow and Ryan 2006). The site is a low-density scatter of chipping waste with a low- to moderate-density scatter of marine shell and fire-cracked cobbles.

CA-SBA-3277 was recorded as a sparse scatter of lithic debris, marine shell, and bone. It is entirely exposed within active wind-eroded dunes.

CA-SBA-3278 was recorded as a small (30 by 20 meters) sparse lithic scatter on an exposed wind-swept surface.

CA-SBA-3833H was recorded as a large scatter of concrete debris, milled lumber, bottle glass, rifle bullets and cartridges, metal fragments, and a can scatter. The material all appears to be related to military activities. A white shale gravel road runs through the site.

CA-SBA-3917 was recorded by Lebow during the reconnaissance of the restoration areas in 2007 (Peterson et al. 2008). The site consists of two concentrations of lithic debris that appear to represent early-stage cobble reduction. Each concentration is approximately three meters in diameter, within a wind deflated area between vegetated hummocks.

Area D

CA-SBA-3544H is a set of erosion control pilings, probably installed by the railroad in the 1930s, north of Area D. They are in the water much of the time.

P-42-040919 is a recently recorded historical site. In September 2006, VAFB security personnel found individuals digging in, what appears to be, a historical trash scatter. The

30 CES/CEVNC and VAFB Security Forces initiated an Archaeological Resources Protection Act investigation. Most of the material recovered by the bottle hunters dates to the 1960s, but there appears to be material from the 1940s and possibly earlier as well. It is probably associated with the community of Surf, which was once a thriving village, with over 50 buildings by the 1950s. Nothing remains of the community today.

3.4 Hazardous Materials and Waste Management

Hazardous materials and wastes are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601-9675), Toxic Substances Control Act (15 U.S.C. 2601-2671), the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901-6992), and as defined in the State of California corresponding laws and regulations. In addition, federal and state Occupational Safety and Health Administration (OSHA) regulations govern protection of personnel in the workplace. In general, the definitions within the citations include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health and welfare, to workers, or the environment.

3.4.1 Hazardous Materials Management

VAFB uses approximately 5,000 hazardous materials items to accomplish its mission and mission support activities. The hazard potential of the materials used range across the spectrum of toxicity. Users of hazardous materials must also comply with California Business Plan requirements. Management of hazardous materials used on VAFB follows procedures found in 30th Space Wing Plan (30 SWP) 32-7086, *Hazardous Materials Management Plan*. The Base uses a Hazardous Materials Pharmacy (HazMart), wherein the HazMart maintains inventories of hazardous materials, whether purchased by the Air Force or its contractors. Before releasing hazardous materials to the user, HazMart staff ensures a copy of the Material Safety Data Sheet (MSDS) is available and verifies that the material is suitable for use on VAFB. By providing handling and use information, VAFB controls the potential misuse of hazardous materials, maintains an accounting of the types of hazardous materials used on Base, and accomplishes usage and emissions reports as required by federal, state, and local environmental regulations.

Hazardous materials used during habitat restoration activities include herbicides and petroleum, oil, and lubricants (POLs) in equipment and vehicles.

3.4.2 Hazardous Waste Management

Management of hazardous waste at VAFB complies with the RCRA Subtitle C (40 CFR Part 240-299) and with California Hazardous Waste Control Laws as administered by the California EPA, Department of Toxic Substances Control, under Title 22, Division 4.5 of the California Code of Regulations. These regulations require that hazardous wastes be handled, stored, transported, disposed of, or recycled according to defined procedures. The VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A, outlines the procedures to be followed for hazardous waste management.

Contractors generating hazardous wastes in support of a government contract are required to follow federal, state and local laws and regulations, and use the Air Force Generator Identification Number to account for hazardous wastes generated. Because of the amount of hazardous waste generated per month under its Generator Identification Number, VAFB is classified as a large quantity, fully regulated generator, required to comply with all laws regulating the generation, storage, transportation, and disposal of

hazardous waste. VAFB employs a "cradle to grave" waste management approach. Hazardous waste is accumulated following rules applicable to either the larger quantity or small quantity generator status. Waste is transferred off-site in properly labeled Department of Transportation approved container from its point of origin to a permitted off-site treatment storage or disposal facility. The VAFB *Hazardous Waste Management Plan* (30 SWP 32-7043A) provides detailed procedures for hazardous waste accumulation and management. Construction/demolition contractors would use the VAFB Generator Identification Number, and would have to comply with the VAFB *Hazardous Waste Management Plan* (30 SWP 32-7043A). Hazardous waste is removed from VAFB under hazardous waste manifest and shipped off-site for final disposal.

3.4.3 Herbicide Management

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA [7 U.S.C. 136 et seq.]) regulates the manufacture, use, storage, and disposal of chemicals used as herbicides as described in 40 CFR Parts 150-180. The FIFRA is implemented in Department of Defense (DOD) Directive 4150.7, *Pest Management Program*. The VAFB Pest Management Program is managed through the installations Pest Management Quality Assurance Personnel, assigned to the 30th Civil Engineer Squadron, Operations Flight Service Contracts (30 CES/CEOEC). The VAFB Integrated Pest Management Plan is VAFB's primary document for implementing the objectives of facility herbicide management, and ensures compliance with applicable federal, state, and local regulations.

Detailed herbicide application contract requirements include proof that all personnel have a valid State of California pesticide applicator license or certificate; and submittal of labels and MSDS for all herbicide materials to the 30 CES/CEOEC, monthly herbicide use reports to the 30 CES/CEOEC and Santa Barbara County agricultural commissioner, and a Spill Prevention Plan for 30 CES/CEV approval. Monthly herbicide usage totals are submitted to the VAFB HazMart by the 30 CES/CEOEC.

3.4.4 Installation Restoration Program

The federal Installation Restoration Program (IRP) was implemented at DOD facilities to identify, characterize, and restore hazardous substance release sites. There are currently 136 IRP sites throughout VAFB grouped into six Operable Units based on similarity of their characteristics.

IRP sites are remediated through the Federal Facilities Site Remediation Agreement (FFSRA), a working agreement between the USAF, the Central Coast Regional Water Quality Control Board (RWQCB), and the Department of Toxic Substances Control. In addition to IRP sites, there are identified Areas of Concern (AOCs), where potential hazardous material releases are suspected; and Areas of Interest (AOIs), defined as areas with the potential for use and/or presence of a hazardous substance. Various contaminants could be present at these sites including trichloroethylene, polychlorinated biphenyls, volatile organic compounds (VOCs), total petroleum hydrocarbons, asbestos, and other hazardous contaminants.

Two AOCs; AOC-034 and AOC-167, occur within the boundaries of proposed restoration areas. These sites are described below.

AOC-034

This site is located south of Ocean Beach County Park, near Surf Beach, and represents an area that was active from the early 1900s to the 1950s as a train depot. The area has been identified as an AOC due to potential oil stained soil between the older set of railroad tracks, potential oil storage tank sites, and asbestos floor tiles noted at an old building site and along the tracks in either direction. AOC-034 is a "third party site"; that is, VAFB leases the property to another entity. The third party is responsible for clean up actions.

AOC-167

This site is located within the northeastern portion of Area C, approximately 3,500 feet northwest of Building 1799 on the west side of the Southern Pacific railroad tracks. The area consists of the fenced burial of an air defense missile that crashed on August 24, 1966. Subsequently, 3 lbs of radioactive thorium-magnesium alloy were buried 6 feet below the ground surface. There have been no intrusive field investigations at this AOC. Buried radioactive material will be left in place with institutional controls. Annual surface radiation surveys have not detected radiation levels above background at this site.

3.5 Human Health and Safety

All construction activities and facility operations and maintenance on VAFB are subject to the requirements of the federal OSHA, and Air Force Occupational Safety and Health regulations. Moreover, California OSHA has jurisdiction over non-federal operations south of Honda Ridge Road on South VAFB.

The affected environment for Health and Safety is the regulatory environment for health and safety issues established to minimize or eliminate potential risk to the general public and personnel involved in habitat restoration activities.

Relevant health and safety requirements include industrial hygiene and ground safety. Industrial hygiene is the responsibility of the 30 SW Safety Office (30 SW/SE) and Bioenvironmental Engineering, and contractor safety departments. Responsibilities include monitoring and exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations. Ground safety is the responsibility of 30 SW/SE and includes protection from hazardous situations and hazardous materials.

Hazardous materials primarily POLs, and herbicides would be used for operating equipment and vehicles, and for restoration activities under the Proposed Action and Alternative C. The potential exists for unexpected releases of these POLs and herbicides, which would generate hazardous waste. Therefore, the potential exists for persons participating in restoration activities to become exposed to hazardous materials and hazardous waste. In addition, the following physical features have the potential to be present in the vicinity of project areas, and have the potential to adversely impact the health and safety of site workers:

- Physical hazards including traffic on the roads, holes and ditches, uneven terrain, sharp or protruding objects, slippery soils or mud, and unstable ground.
- Biological hazards such as animals (insects, spiders, and snakes), and disease vectors (ticks and rodents).

Unexploded Ordnance

Several areas on VAFB were used as ordnance training ranges and have the potential to contain unexploded ordnance (UXO). Since ordnance can be found on Base, the Explosive Ordnance Disposal (EOD) Flight must coordinate on all ground disturbing projects. According to EOD guidance, if ordnance is found on-site, it should not be disturbed. Workers in the vicinity must be alerted to the danger and directed away from it, and the EOD Flight must be contacted.

3.6 Land Use and Aesthetics

Visual resources and landscape elements on VAFB include natural features such as gently rolling hills, canyons, creeks, sand dunes, and beaches. Man-made features on Base include the airfield, launch pads, residential development, industrial facilities, and other structures typical of a military installation. Visual resource sensitivity is dependent on the type of user, the amount of use, and viewer expectations. Because the mission of VAFB is the development of U.S. space and

missile programs, viewers are familiar with the existing man-made features on Base associated with these programs.

The western boundary of VAFB, characterized by long sandy beaches, is 41 miles of undeveloped coastline. It is the largest stretch of central California coastline managed by a single entity. Sandy beaches on VAFB stretch almost continuously from south of Lion's Head, an area of rocky outcrops on North Base, to approximately 4 miles south of the Santa Ynez River on South Base. Outside this area, the coastline of VAFB is rocky or has steep coastal bluffs with occasional sandy coves (VAFB *In Progress*).

Land use areas on both North and South VAFB include recreational use of the beaches by the public and/or military. Immediately adjacent to the coast is open space set aside for security and safety buffer zones during launch activities. Wall and Surf Beaches are the most heavily used of the recreational beach areas.

Coastal Zone Management

Federal activity in, or affecting the California coastal zone requires preparation of a Coastal Zone Consistency Determination or a Negative Determination, in accordance with the federal CZMA of 1972. The California Coastal Zone Management Program was formed through the California Coastal Act (CCA) of 1972. The Air Force is responsible for making final coastal zone consistency determinations for its activities within the state. The California Coastal Commission reviews federally authorized projects for consistency with the California Coastal Zone Management Program.

On VAFB, the coastal zone extends inland from approximately 0.75 mile at the northern boundary to 4.5 miles at the southern end of Base. All alternatives, including the No-Action Alternative (Alternative B) are located within the coastal zone, thus their implementation would require concurrence from the California Coastal Commission with a Consistency Determination or a Negative Determination.

3.7 Water Resources

Water resources include surface water and groundwater and their physical, chemical, and biological characteristics. Surface water includes lakes, rivers, streams, and wetlands, while groundwater refers to water below the surface.

In California, the State Water Resources Control Board and the RWQCB administer the state National Pollutant Discharge Elimination System (NPDES) Program. Section 402 of the Clean Water Act (CWA) mandates the NPDES program, and U.S. EPA regulations provide the authority and framework for state regulations. The NPDES Construction General Permit regulates construction sites of 1 acre or more in California, and ensures that water discharged from a site meets water quality standards. State regulations require a Waste Discharge Requirement for permitting discharge.

The Central Coast RWQCB is the local agency responsible for the VAFB area. The Central Coast RWQCB Water Quality Control Plan (Basin Plan) provides a framework for establishing beneficial uses of water resources and the development of local water quality objectives to protect these beneficial uses.

3.7.1 Surface Water and Floodplains

The major freshwater resources of the VAFB region include six streams, comprising two major and four minor drainages. The major drainages are San Antonio Creek and the Santa Ynez River. The minor drainages include Shuman, Bear, Cañada Honda, and Jalama Creeks. San Antonio Creek and the Santa Ynez River are the primary collection basins for runoff from VAFB. Although their collection basins are extensive, flow in these two streams is seasonal because of low precipitation and upstream damming. The general storm water rainy season at VAFB is

from October 1 to April 15. This timeframe has the greatest potential of site pollutant runoff. The average annual rainfall is approximately 14.8 inches (unpublished data, 30 SW).

The project areas under the Proposed Action and Alternatives are located within the San Antonio Creek and Santa Ynez River drainage basins and floodplains.

3.7.2 Groundwater

The VAFB water supply primarily comes from water purchased from the California Department of Water Resources State Water Project. Aquifers capable of yielding large quantities of water usable for water supply are generally restricted to the deeper portions of the Santa Ynez River and San Antonio Creek (USAF 1998). Four wells located in the San Antonio Creek-Barka Slough area are used to supplement the VAFB state water during annual maintenance periods. The greatest threat to groundwater is contamination from hazardous material or waste releases that could infiltrate an aquifer. The only local ground drinking water sources are the water wells located near Barka Slough, which are approximately 9.5 miles upstream from the restoration areas on San Antonio Beach.

Chapter 4. Environmental Consequences

This chapter presents the results of the analysis of potential environmental effects of implementing the Proposed Action and Alternatives as described in Chapter 2. For each environmental component, anticipated impacts are assessed considering short- and long-term effects.

4.1 Air Quality

The criteria for determining the significance of air quality impacts are based upon federal, state, and Santa Barbara County standards and regulations. Impacts would be considered significant if project emissions increase ambient pollutant concentrations from below the NAAQS or CAAQS to above these standards, or if they contribute measurably to an existing or projected ambient air quality standard violation.

In non-attainment or maintenance areas, federal agencies are required to prepare a conformity determination to prevent federal actions from causing an exceedance of a national ambient air quality standard. To reduce the time and resources federal agencies expend in preparing conformity determinations, the U.S. EPA developed de minimis levels that serve as thresholds for focusing on those actions likely to have the most significant impacts. The U.S. EPA deemed that emission levels below the de minimis levels were not significant.

As of June 15, 2005, Santa Barbara is in attainment of all federal air quality standards, and federal agencies are no longer required to prepare conformity determinations. However, VAFB believes the threshold levels used in conformity determinations are still relevant for use as thresholds for determining if air quality impacts would be significant. The rationale used by the U.S. EPA to develop the thresholds for nonattainment areas is no less applicable for areas in attainment. Although VAFB is no longer required to observe the significance levels required in conformity determinations, voluntary use of them provides a conservative approach to determining air quality impacts.

Maintenance areas have de minimis levels of 100 tons per year (tons/yr) for NO_x. The VOC limits are 50 tons/yr for areas inside an ozone transport region and 100 tons/yr outside that region. Using a 365-day year, these de minimis levels equate to significance levels of 548 pound per day (lbs/day) of NO_x, and 274 or 548 lbs/day for VOCs for areas inside and outside of an ozone transport region, respectively. VAFB will apply the 100 tons/yr or 548 lbs/day VOC significance threshold. If Santa Barbara County becomes part of an Ozone Transport Region under the CAA, VAFB will reassess its VOC significance threshold. VAFB will use these levels, 100 tons/yr or 548 lbs/day of NO_x, or VOC, for determining whether or not air quality impacts are significant.

4.1.1 Alternative A: Proposed Action

Invasive plant species eradication and habitat restoration activities under the Proposed Action would occur over a 5-year period, with most of the activities taking place during the first 2 years. Fugitive dust emissions generated from equipment operating on exposed ground and combustive emissions from the equipment would cause adverse air quality impacts. Likewise, emissions from fire treatment at selected sites would also cause adverse air quality impacts. The largest adverse impacts would occur when vehicles disturb the soil on-site, and during implementation of fire treatment.

A list of equipment proposed for activities under the Proposed Action is included in

Appendix B, Table B-1. This list was used to prepare the detailed air emissions inventory presented in Appendix B. Emission factors used to estimate the emissions are found in Table B-2. For purposes of this analysis, it was estimated that an average of 0.58 acre per day would be disturbed. It was further estimated that on a reasonable worst-case day, 1.73 acres would be disturbed. With a disturbance of 8-hours per day, the reasonable worst-case day fugitive dust emissions would be 48.32 lbs/day of PM_{l0}. These emissions would not be expected to cause an exceedance of any ambient air quality standard and therefore there would be no significant impacts from PM_{10}.

The methodology and assumptions used to estimate the emissions are presented in Appendix B. The estimated daily and total emissions for the project can be found in Table B-3 and Table B-4, respectively. The daily emissions were estimated to be 291.53 pounds (lbs) of CO, 17.28 lbs of NO_x, 49.14 lbs of PM_{10}, 14.95 lbs of ROC, and less than 1 pound of SO_x. Emissions from the Proposed Action would not exceed the significance thresholds of 548 lbs/day or 100 tons/yr. Therefore, no adverse impacts to the region's air quality would occur.

4.1.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Air Quality during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Application of fire treatments would be in accordance with all state and local policies and procedures. A Burn Plan would be developed and submitted to the SBCAPCD.
- Before construction begins under the Proposed Action, portable equipment meeting the criteria defined in the *Emergency Regulation Order,* effective April 27, 2007 for the California Portable Equipment Registration Program (PERP) would be registered in the program or have a valid SBCAPCD Permit to Operate.
- Equipment usage and fuel consumption would be documented and reported to 30 CES/CEV to facilitate tracking emissions for inclusion in the VAFB Air Emissions Inventory.

Although significant emissions are not anticipated from the Proposed Action, the following SBAPCD dust control measures would be implemented to further decrease fugitive dust emissions from ground disturbing activities:

- Vehicle speeds would be minimized on exposed earth.
- Ground disturbance would be limited to the smallest, practical area and to the least amount of time.

In addition to the above dust control measures, the following control measures would be implemented to decrease diesel emissions:

- When feasible, equipment powered with federally mandated ultra-low sulfur diesel engines would be used.
- Engine size in equipment used for the project would be minimized.
- The use of equipment would be managed to minimize the number of pieces of equipment operating simultaneously and total operation time for the project.
- Engines would be maintained in tune per manufacturer or operator specification.
- CARB-certified low diesel fuel would be used.
- If feasible, U.S. EPA or CARB-certified diesel catalytic converters, diesel oxidation catalysts, and diesel particulate filters would be installed.
- When feasible, equipment powered by diesel engines retrofitted or re-engined to meet the Air Toxics Control Measures for Off-Road Vehicles would be used.

Given the requirements of EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and the increasing concerns that greenhouse gases contribute to Global Climate Change, the 30 CES/CEV will take into consideration and encourage measures that promote efficiency and conservation through education, programs, and incentives to increase efficiency and conserve energy in projects on VAFB.

4.1.3 Alternative B: No-Action Alternative

Under the No-Action Alternative, there would be no activities associated with snowy plover habitat restoration. Therefore, no impacts to air quality would occur as a result of emissions associated with project activities.

4.1.4 Alternative C

Under this Alternative, acacia within Area D would not be mechanically removed and prescribed fire applied to eliminate the dead biomass. Other operational aspects under this alternative would be the same as those described under the Proposed Action. Although air emissions would differ slightly from those estimated under the Proposed Action, these differences would be insignificant when considering the entire project. Therefore, potential adverse impacts associated with this Alternative would be of the same magnitude as those of the Proposed Action (Section 4.1.1).

4.2 Biological Resources

4.2.1 Alternative A: Proposed Action

Under the Proposed Action, habitat restoration at specific locations within 440 acres of lower beach and foredunes has the potential to result in short-term temporary adverse effects to biological resources in the immediate area of disturbance, and long-term permanent beneficial effects from improved habitat and ecological function. Specific effects of implementing the Proposed Action on botanical and wildlife resources are discussed in more detail below, and potential related effects to special status species are summarized in Table 4-1. Measures to minimize or avoid adverse effects on natural resources and special status species during project implementation are summarized in Section 4.2.2, Environmental Protection and Monitoring Measures.

4.2.1.1 Botanical Resources

Potential effects to plant communities and plant species include:

- Short-term (temporary) loss of habitat from restoration related activities such as access, prescribed fire, herbicide application, and dune contouring.
- Loss of individuals within the restoration areas due to herbicide and prescribed fire exposure; excavation; crushing; or burial.
- Loss of individuals in habitats adjacent to restoration areas due to sand movement.
- Long-term increase of biological diversity and habitat value.

Approximately 440 acres of coastal strand and foredune communities occur within the proposed project areas and have the potential to be affected as a result of habitat restoration activities. Some native vegetation may be lost during project implementation; however, removal of invasive species within the restoration areas would eliminate direct competition for resources. Beachgrass and iceplant suppress native plant species resulting in decreased diversity. Removal of these invasive non-native species within the proposed sites would result in natural recruitment by native plant species, increasing the biological diversity of these areas. Glyphosate-based herbicides, including Roundup PRO®, are inactivated upon contact with soil and therefore would not affect the seed bank.

Removal of invasive species is expected to increase wind blown sand movement within the project areas. After herbicide application, plants would be allowed to decompose

Table 4-1. Potential Proposed Action related effects on special status species.

Scientific Name **Common Name**	**Status**		**Occurrence**	**Potential Effects**
	USFWS[1]	**CDFG[2]**		
Plants				
Cirsium rhothophilum Surf thistle		ST	Documented	Loss of individuals within restoration areas. Long-term increase in availability of quality habitat.
Dithyrea maritima Beach spectacle pod		ST	Documented	Loss of individuals within restoration areas. Long-term increase in availability of quality habitat.
Deinandra increscens ssp. *villosa* Gaviota tarplant	FE	SE	Documented	Loss of individuals and seed bank within access routes.
Invertebrates				
Euphilotes battoides allyni El Segundo blue butterfly	FE		Documented	Loss of eggs, larvae, and pupae, and host plant seacliff buckwheat. Long-term increase in availability of high quality habitat.
Birds				
Pelecanus occidentalis californicus California brown pelican	FE	SE	Documented	Disruption of roosting activities.
Charadrius alexandrinus nivosus Western snowy plover	FT	CSC	Documented	Disruption of roosting and foraging activities of wintering juveniles and adults. Long-term increase in availability of high quality habitat.
Sterna antillarum browni California least tern	FE	SE	Documented	Long-term increase in availability of high quality habitat.

NOTES:
1 FE = Federal Endangered Species FT = Federal Threatened Species FD = Federal Delisted Species
BCC = Federal Bird of Conservation Concern
2 SE = State Endangered Species ST = State Threatened Species CSC = California Species of Concern

naturally without physical removal to discourage sand movement. Some native vegetation may be lost by sand burial; however, areas proposed for habitat restoration under the Proposed Action are expected to return to self-sustaining native vegetation types.

4.2.1.2 Wildlife Resources

The potential effects to wildlife species associated with the Proposed Action include:

- Short-term (temporary) loss of habitat from restoration related activities such as removal of vegetation.
- Short-term (temporary) abandonment of roosting sites due to project related noise and associated disturbance.
- Disruption of foraging or roosting activities due to project related noise and associated disturbance.
- Exposure to herbicide and fire treatments.
- Long-term (permanent) benefits from improved habitat and a healthier coastal ecosystem.

Wildlife, including mammals, amphibians, reptiles, and birds, present in the vicinity of the restoration activities could be affected by project generated noise. Wildlife response to noise can be physiological or behavioral. Physiological responses can range from mild, such as an increase in heart rate, to more damaging effects on metabolism and hormone balance. Behavioral responses to man-made noise include attraction, tolerance, and aversion. Each has the potential for negative and positive effects, which vary among species and individuals of a particular species due to temperament, sex, age, and prior experience with noise. Responses to noise are species-specific; therefore, it is not possible to make exact predictions about

hearing thresholds of a particular species based on data from another species, even those with similar hearing patterns.

Potential impacts to wildlife species from human presence, project generated noise, and disturbance associated with project implementation include temporary disruption of foraging and roosting activities and loss of habitat. Wildlife species would be expected to move away from the areas of disturbance during restoration activities. These disturbances would be considered short-term and temporary and would not be considered of a magnitude to result in adverse impacts to populations within the vicinity of the project areas, given the availability of ample habitat available in the surrounding areas. Areas proposed for habitat restoration under the Proposed Action are anticipated to return to natural plant communities, and wildlife species are expected to return to these areas.

Wildlife species occurring within or adjacent to restoration areas could be exposed to herbicide drift, and vegetation with herbicide residues. Glyphosate is practically non-toxic to wildlife species (U.S. EPA 2003); it does not bioaccumulate or break down (Brewster et al. 1991). With the infrequent treatment applications and low toxicity levels, no adverse effects would be expected from herbicide exposure.

The Migratory Bird Treaty Act provides federal protection to native avian species, their nests, eggs, and unfledged young. Restoration activities would be scheduled between October 1 and February 29, outside the normal breeding season for avian species known to breed within the project areas.

4.2.1.3 Special Status Species

El Segundo Blue Butterfly

El Segundo blue butterfly was documented at several locations within the coastal dune scrub community adjacent to the restoration areas on North Base (MSRS et al. 2008). The presence of seacliff buckwheat within and adjacent to the project areas is indicative of the potential for this federally endangered species to also occur within these areas. Because restoration activities would occur between October 1 and February 29, after the butterfly's flight period (June through August), no adverse effects are anticipated to adult butterflies. Adverse effects to butterfly eggs, larvae and pupae, and to its host plant seacliff buckwheat would be avoided by isolating and protecting individual plants from disturbance. On December 19, 2007, the USFWS concurred with the Air Force that no adverse effects would result on this species given the protective measures to be used during implementation of restoration efforts (USFWS 2007b).

Gaviota Tarplant

Gaviota tarplant occurs within the ruderal community located along the road shoulders of North Spur Road and within Road 3, on North Base. These roads would be used for equipment and personnel access to restoration sites. Restoration activities would occur between October 1 and February 29, after the plants have senesced (approximately October to April) and seed has set. Rubber-tired vehicles would be used to avoid disturbance to the seed bank and soil compaction. Therefore, no adverse effects to this species are anticipated to occur. On December 19, 2007, the USFWS concurred with the Air Force that no adverse effects would result on this species given the protective measures to be used during implementation of restoration efforts (USFWS 2007b).

Surf Thistle and Beach Spectacle Pod

Both surf thistle and beach spectacle pod occur sporadically throughout coastal strand communities on VAFB. These species have been documented within project areas under the Proposed Action and Alternative C. Surveys would be conducted immediately prior to the start of restoration activities within each restoration site to document the presence of any individual plants and determine the best protective measures to avoid or minimize adverse effects to these species. If adverse effects are unavoidable,

the Air Force proposes collecting seed for propagation upon completion of ground disturbing activities.

California Brown Pelican

California brown pelicans are known to roost within project areas under the Proposed Action. This species does not breed on VAFB. Disturbances resulting from the presence of human activity would disrupt roosting activities. Because these disturbances would be short-term, and additional suitable habitat not subject to these temporary disturbances is available in the vicinity, adverse effects would be less than significant.

Western Snowy Plover

Snowy plovers winter and breed within the areas proposed for habitat restoration. All alternatives presented in this EA would have a direct effect on snowy plovers and breeding habitat on VAFB. Restoration activities would occur outside of the breeding season for this species (March 1 through September 30). During project implementation, wintering snowy plovers would be present within the project areas roosting and foraging. Disturbances resulting from human presence would temporarily disrupt these activities. Additional suitable habitat not subject to these disturbances is available in the vicinity. Eradication of non-native vegetation and restoration with native species would have a direct beneficial effect on snowy plovers by increasing the amount of breeding habitat available on VAFB.

4.2.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Biological Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- All restoration activities would be scheduled to occur outside of the snowy plover breeding season, which extends from March 1 through September 30 or prior if restrictions are lifted.
- Qualified biologists would place protective covering over all seacliff buckwheat plants during chemical treatment of nearby invasive species to protect El Segundo blue butterfly pupae and prevent loss of habitat. The protective covering would be removed as soon as possible following herbicide application.
- Qualified biologists would brief all project personnel prior to participating in project implementation activities. At a minimum, the briefing would include a description of the special status species occurring in the area, general provisions of the ESA, general measures being implemented to conserve the species in the project area, and specific measures and restrictions regarding project implementation.
- Herbicide application would occur only during no- or low-wind conditions. Herbicide applications would not occur within 12 hours of a forecasted rain or extreme high tide event, or when vegetation surfaces are covered with precipitation from recent rainfall or dew.
- Annual monitoring and progress reports would be submitted to the 30 CES/CEV.
- The Air Force would coordinate the Proposed Action with the California Coastal Commission in compliance with the CZMA.

4.2.3 Alternative B: No-Action Alternative

Under the No-Action Alternative, invasive species eradication and habitat restoration activities would not occur on VAFB at the proposed locations, and biological resources would not be directly affected by project activities. Implementation of this Alternative would result in significant long-term adverse effects on biological resources. Adverse effects to botanical and wildlife resources, including special status species, include the continued spread and encroachment of non-

native species, increased sand stabilization, increased foredune and hummock development, and further decline in the quality and quantity of native plant communities and wildlife habitat.

4.2.4 Alternative C

Potential adverse impacts to biological resources under this Alternative would be the same as those described under the Proposed Action (Section 4.2.1), except that the project area would be 434 acres (versus 440 acres under the Proposed Action).

4.3 Cultural Resources

Cultural resources would be adversely affected if the Proposed Action and Alternatives would cause loss of the value or characteristics that qualify them for listing on the NRHP, or substantially alters the natural environment, or access to it, in such a way that traditional cultural or religious activities are restricted. The Proposed Action and Alternatives would comply with all relevant authorities governing cultural resources, including Section 106 of the NHPA and Air Force Instruction 32-7065.

A complete inventory of cultural resources was performed within the proposed habitat restoration areas. The cultural resources investigation was a coordinated review that meets the requirements of Section 106 of the NHPA, and the NEPA. Restoration activities were developed to avoid adverse effects to known resources. VAFB reached a Section 106 finding that the Proposed Action would have no adverse effects to historic properties. This finding will be submitted to the California State Preservation Officer (SHPO) for review.

In the event that previously undocumented cultural resources are discovered during restoration activities, procedures established in 36 CFR 800.13 would be followed.

4.3.1 Alternative A: Proposed Action

The following sections discuss the consequences of implementing the Proposed Action on cultural resources within or near each restoration area.

Area A

Area A is primarily a dense patch of beachgrass dunes, in an area immediately south of Shuman Creek and inland from the high tide mark. Archaeological site CA-SBA-710 is located within the area. The beachgrass-covered dunes are not evident in aerial photographs dating to 1960 or older; it appears that beachgrass was introduced some time after 1960 in an attempt to stop sand from blowing inland. Consequently, the dunes themselves are modern. This observation was reinforced by the presence of milled lumber observed protruding from the base of one of the dunes.

The intent of habitat restoration in this area is to remove beachgrass and allow the modern dunes to dissipate. Beachgrass in Area A would be removed by first burning it to remove the thatch build-up (which prevents herbicide penetration) and then application of the herbicide Roundup PRO® Concentrate. Individuals on foot using drip torches would accomplish fire treatment. Chemical treatment would be done using a sprayer mounted on an ATV, equipped with a 200-foot hose to allow an area, 400-feet (122-meters) in diameter, to be reached from the vehicle. Because the dunes containing beachgrass are modern, these activities would not affect CA-SBA-710.

Just inland from the modern dunes containing beachgrass are hummocks containing iceplant, surrounded by wind-deflated surfaces. Erosional profiles of these hummocks reveal some limited soil development, which suggests they are not modern. Therefore, it is possible that they contain intact site deposits, unlike the modern beachgrass dunes. Iceplant on these hummocks would be treated with herbicide applications and dead iceplant would be left in place to help stabilize the hummocks in the

short-term. Revegetation with native species would provide long-term stabilization. Because these hummocks are capped with a layer of modern sand, planting 4-inch pots would not affect any possible buried site deposits. Consequently, eradicating iceplant in Area A would not affect CA-SBA-710.

Area A would be accessed by driving the ATV west through the dunes along an abandoned shale road. At the coastline the route then goes north, below the high tide line, and then east onto the modern beachgrass dunes. This route was selected to avoid impacting CA-SBA-710 and CA-SBA-3833H.

Area B

Area B consists of three swaths of beachgrass growing on sand ridges, forming a rough triangle or "4" shaped figure that has been recorded as P-42-040929. The ridges appear to have developed as a result of sand accumulation along lines of drift fence, apparently installed in the early 1960s along access roads and cable lines to protect the airfield's lighting, communications, and navigation systems. These systems are no longer used by the airfield. Restoration activities would remove beachgrass from the sand ridges, allowing the ridges to dissipate.

Five archaeological sites are within or adjacent to the archaeological study area for Area B: CA-SBA-900, -904, -1754, -3275, and -3348. Of these, only CA-SBA-900, -904, and -3275 are in or adjacent to actual components of the restoration project. Sites CA-SBA-1754 and -3348 were included in the archaeological study area because it was expanded to include all of the SLC-10 National Historic Landmark. However, neither CA-SBA-1754 nor CA-SBA-3348 is within 30 meters of the restoration work, and neither will be affected by restoration activities.

Habitat restoration in Area B would consist of removing beachgrass through a combination of fire and chemical treatment. Precautions would be taken during fire treatment because of the large area that needs to be burned, and the potential for accidental spread of the fires. Immediately southeast of the sand ridges, an abandoned, overgrown paved road would be cleared of vegetation to serve as a primary firebreak. A short segment of an abandoned road going north would also be cleared, connecting to a large sand sheet that would act as a natural firebreak. Fire engines would be parked on these primary firebreaks. In the event that the fire escapes the primary line, a contingency firebreak is planned outside the perimeter of the SLC-10 National Historic Landmark. Heavy equipment would be used to construct this contingency line. However, this line would not be constructed except in the unlikely event that the fire jumps the primary line. In the even more unlikely event that the fire jumps both the primary and contingency lines, fire crews would be standing by with engines to ensure the fire does not reach the facilities at SLC-10.

Following fire treatment, herbicide application would be completed using an ATV-mounted sprayer and 200-foot hose. ATV routes were selected to avoid affecting archaeological resources. All ATV routes were walked by Applied EarthWorks' senior archaeologist (Peterson et al. 2008). Some portions of the access routes are outside known site boundaries. Access routes that are within known sites would be on abandoned roads or on modern sand that provide a buffer between the ATV and the archaeological deposit. In a few places, dense brush prohibits ATV travel along selected routes. In those areas, the brush would be removed with hand tools. Also, in a few short stretches, the terrain along the selected ATV route is too rugged to allow ATV travel. In all of those cases, the route is on a sand ridge with deep modern sand. Hand tools can safely be used to smooth the topography to allow ATV travel without fear of affecting any underlying site deposits. A staging area, located on an existing gravel road, would be used to unload the ATV and park vehicles. Firebreaks, ATV routes, and the staging area in Area B were selected to allow access for beachgrass eradication without affecting archaeological deposits.

Area C

Area C consists of a large number of individual hummocks infested with iceplant. Ten archaeological sites are within or near this area: CA-SBA-709, -710, -774, -900, -901, -902/903, -3277, -3278 -3833H and -3917. Iceplant eradication would follow the strategy discussed above for the inland hummocks in Area A. Chemical treatments would be applied, primarily by reaching the hummocks with the hose from the ATV. In areas that cannot be reached by a hose due to the presence of archaeological sites, and in the sparsely vegetated eastern part of Area C, an individual with a backpack sprayer would apply herbicide. Dead iceplant would be left in place to provide short-term stabilization of hummocks within sites and 4-inch pots containing native plant species would be planted to provide long-term stabilization.

Unlike Area A, where ATV access was restricted to the beach below the high tide line, in Area C the access route meanders through the dune field to approach within easy spraying distance of most hummocks. Applied EarthWorks' senior archaeologist (Peterson et al. 2008) walked all access routes. The access route is outside all site boundaries, except where the access from the east is on an abandoned road through CA-SBA-3833H. At CA-SBA-710 and -901 and -3833H, which extend to the beach, the north to south ATV access route is along the beach below the high tide line. These measures would avoid impacts to cultural resources within this project area.

Area D

CA-SBA-3544H is a series of erosion control pilings set in the Santa Ynez River channel and would not be affected by restoration activities.

P-42-040919 is a historical trash scatter, revealed by unauthorized persons digging in the deposit. No artifacts are visible on the surface, and the extent of the site and its relationship to the area was unknown. Subsurface probing to determine the site's extent was not possible due to the presence of nesting snowy plovers. Consequently, archival research was used to determine the site's extent. Sources examined include a scrapbook about the community of Surf and reference files at the Lompoc Valley Historical Society. Myra Manfina, with the Historical Society, was interviewed, and a local resident (Sonja McKinley Bernard) who lived at Surf between 1949 and 1954 was taken to the site and interviewed. Other sources include old aerial photographs and USGS maps.

Based on the archival research, P-42-040919 is south of a grove of cypress trees still present, and is largely associated with a terraced landform at the western edge of the railroad. The restoration area does not include the terraced platform at the western edge of the railroad, thus the portion of the site representing the residential area is outside the project area. However, as demonstrated by the unauthorized excavations and verified by the former resident, trash deposits associated with the site extend beyond the terraced platform.

Consequently, Area D was divided into two portions for purposes of habitat restoration, with the dividing line placed 197 feet (60 meters) north of the cypress trees marking the northern edge of the residential portion of P-42-040919. The 197 feet (60 meters) serves as a buffer. North of the dividing line, beachgrass would be initially treated with fire application. Beachgrass sprouts following fire application and iceplant would be treated with herbicide. Mechanical contouring of dunes would occur within this area after adequate invasive plant removal has been completed. The intent is to remove not only the dead vegetation but also the associated modern dune buildup. Access for the heavy equipment is from the north. Equipment would access the beach from the Wall Beach parking lot and travel south below the high tide line, crossing the sand bar at the mouth of the Santa Ynez River during low tides.

South of the dividing line, approximately 6 acres of acacia would be mechanically

removed above the ground surface. Fire treatment would be used to eliminate the aboveground biomass of large beachgrass infestations and acacia material. Chemical treatments would be used to eliminate iceplant, isolated beachgrass infestations, and beachgrass sprouts following fire treatment. After herbicide application, plants would be allowed to decompose naturally without physical removal. These measures would avoid impacts to site P-42-040919.

4.3.2 Alternative B: No-Action Alternative

Under the No-Action Alternative, the proposed habitat restoration would not occur, and there would be no adverse effects to cultural resources.

4.3.3 Alternative C

Under this Alternative, the same potential adverse effects as described under the Proposed Action (Section 4.3.1), could occur. Implementing the measures described under the Proposed Action, would minimize potential adverse effects.

4.4 Hazardous Materials and Waste Management

Potential impacts as a result of hazardous materials and waste are evaluated using federal, state, and local regulatory requirements, contract specifications, and Base operating constraints, as outlined in Chapter 3, Section 3.4. Hazardous materials management requirements are found in federal and state EPA and OSHA regulations, contract specifications and the VAFB *Hazardous Materials Management Plan* (30 SWP 32-7086). Hazardous waste management requirements are found in federal, state, and local regulations, contract specifications and the VAFB *Hazardous Waste Management Plan* (30 SWP 32-7043A). Non-compliance with applicable regulatory requirements, human exposure to hazardous materials and wastes, or environmental release above permitted limits, would be considered adverse impacts.

4.4.1 Alternative A: Proposed Action

The contractor would be subject to hazardous materials and waste management regulations as required by federal, state and local laws and regulations, and would follow procedures as outlined in the VAFB *Hazardous Materials Management Plan* (30 SWP 32-7086) and VAFB *Hazardous Waste Management Plan* (30 SWP 32-7043A).

Implementing the Proposed Action would require the use of hazardous materials. As described in Chapter 3, Section 3.4, these hazardous materials would be the same types as currently used and managed on VAFB. Because the Proposed Action would be spread over 5 years at 5 months per year and a small number of workers would be working at any one time, there would not be a significant increase in the amounts of hazardous materials present on VAFB. Thus no significant adverse impacts are anticipated.

Potential adverse effects could result from accidental releases of POLs from vehicle and equipment leaks, or the accidental release of herbicides during chemical treatment. All hazardous wastes would be properly managed and disposed of in accordance with applicable federal, state and local hazardous waste regulations, and the VAFB *Hazardous Waste Management Plan* (30 SWP 32-7043A). All hazardous wastes would be managed during release response and clean-up.

Compliance with all applicable federal, state and local regulations, rules and requirements, and applicable VAFB plans, would govern all actions associated with implementing the Proposed Action, and would minimize the potential for adverse effects.

Potential IRP impacts are evaluated using DOD and Air Force guidance, and the FFSRA, as negotiated between VAFB and the regulatory agencies with oversight of VAFB IRP activities. Non-compliance with the

FFSRA, human exposure to contaminants, or environmental release above permitted limits, would be considered adverse impacts.

As described in Section 3.4.3, two AOCs have been identified within the boundaries of the Proposed Action. AOC-167 is located within a fenced area and restoration activities would not occur within this site. Excavation, including dune contouring activities, would not occur within the boundaries of AOC-034. The potential exists for contact with contaminants considered a risk to human health if the nature and extent of contamination are not fully identified prior to proposed restoration activities. If any contamination is detected during restoration activities, the 30th Civil Engineering Squadron, Environmental Flight, IRP Office would be contacted immediately.

4.4.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Hazardous Materials and Waste Management during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Herbicide application would be performed by individuals with a valid State of California pesticide applicator license or certificate.
- The chemical treatment application, disposal, mixing, and loading protocol would be in strict accordance with the product label, VAFB pest management plan, and federal, state and local regulations.
- All hazardous materials would be properly identified and used in accordance with manufacturer's specifications to avoid accidental exposure to or release of hazardous materials required to operate and maintain equipment.
- Standard procedures would be used to ensure that all equipment is maintained properly and free of leaks during operation, and all necessary repairs are carried out with proper spill containment. The construction contractor would submit a Spill Prevention Plan for 30 CES/CEV approval.
- Hazardous materials would be properly stored and managed in secured areas.
- Monthly pesticide use reports would be submitted to the VAFB botanist and pesticide officer, and the Santa Barbara County agricultural commissioner.

4.4.3 Alternative B: No-Action Alternative

Under the No-Action Alternative, habitat restoration at selected coastal beach locations on VAFB would not be implemented and, therefore, there would be no change in the management or levels of hazardous materials and waste on VAFB.

4.4.4 Alternative C

Under this Alternative, the same potential adverse effects as described under the Proposed Action (Section 4.4.1), could occur. Implementing the measures described under the Proposed Action, would minimize potential adverse effects.

4.5 Human Health and Safety

4.5.1 Alternative A: Proposed Action

The contractor would comply with OSHA regulations, and other recognized standards and applicable Air Force regulations or instructions. The contractor must also provide for the health and safety of workers and all subcontractors who may be exposed to their operations or services. The contractor must submit a health and safety plan to Base and appoint a formally trained individual to act as safety officer. The appointed individual would be the point of contact on all problems involving job site safety. During performance of work, the contractor must comply with all provisions and procedures prescribed for the control and safety of personnel and visitors to the job site. Therefore, human health and safety would not be adversely impacted by general restoration hazards.

Beach visitors recreating within or adjacent to restoration areas could be exposed to herbicide drift, vegetation with herbicide residues, or herbicide resulting from an accidental spill. With the implementation of the Environmental Protection and Monitoring Measures outlined in Section 4.5.2, potential health risks to project personnel and the public would be minimal, if any.

Other Potential Hazards

Under the Proposed Action, potential physical hazards typical of any outdoor environment, including holes or ditches, uneven terrain, sharp or protruding objects, slippery soils or mud, and biological hazards including vegetation (i.e. poison oak and stinging nettle), animals (i.e. insects, spiders, and snakes), and disease vectors (i.e. ticks, rodents), exist at and near the proposed restoration areas, and have the potential to adversely impact the health and safety of project personnel. Adherence to federal OSHA regulations would minimize the exposure of workers to these hazards.

Unexploded Ordnance

Special precautions need to be taken in certain areas of VAFB that were used as practice ranges for artillery firing, referred to as areas of potential UXO. Coordination with the EOD Flight prior to implementing the Proposed Action would ensure no adverse effects on human health and safety occur.

4.5.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Human Health and Safety during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- To provide for the health and safety of workers and visitors who may be exposed to the operations of the Proposed Action, the contractor would comply with federal OSHA requirements over the entire project.
- The contractor would also supply a health and safety plan to VAFB. Additionally, the contractor would coordinate with the EOD Flight prior to implementing the Proposed Action to ensure no adverse effects on human health and safety would occur from unexploded ordnance issues.
- To minimize the potential adverse impacts from biological hazards (e.g., snakes and poison oak) and physical hazards (e.g., rocky and slippery surfaces), awareness training would be incorporated into the worker health and safety protocol.
- Beach areas would be closed to recreational use during application of fire treatments.
- Bilingual (English-Spanish) signage would be used to inform visitors of beach closures and herbicide application 48 hours in advance.

4.5.3 Alternative B: No-Action Alternative

Under the No-Action Alternative, the proposed habitat restoration would not be implemented and, therefore, there would be no impacts to human health and safety at VAFB.

4.5.4 Alternative C

Under this Alternative, the same potential adverse effects as described under the Proposed Action (Section 4.5.1), could occur. Implementing the measures described under the Proposed Action, would minimize potential adverse effects.

4.6 Land Use and Aesthetics

Factors considered in the evaluation of the environmental consequences of implementing the Proposed Action and Alternatives for land use include:

- public accessibility to and interactions with recreational areas in the vicinity of the project areas and VAFB; and
- aesthetic values as described under the CZMA and the CCA.

4.6.1 Alternative A: Proposed Action

Access to Surf/Ocean Beach would be restricted for 2 to 4 days during eradication efforts. This would represent a short-term, temporary adverse effect to beach goers. However, because there are additional beach areas that would not be affected, this adverse effect would not be significant.

Under the Proposed Action, habitat restoration would occur within the existing annual snowy plover nesting closure areas. Long-term changes in recreational opportunities and access would not occur as a result of increased quality and quantity of snowy plover breeding habitat on VAFB.

Beachgrass accumulates sand, creating dunes and ridges, which obstruct beach and ocean views. Removal of this invasive non-native species within the proposed sites would enhance the aesthetic qualities of these areas.

Coastal Zone Management

The CZMA and CCA mandate that the scenic and visual qualities of coastal areas be considered and protected as a resource of public importance. The CCA also provides protection of public access to coastal areas. The areas proposed for habitat restoration are located within the California Coastal Zone and situated along the ocean or other scenic coastal areas. No adverse impacts to the coastal zone, as defined by the CZMA and CCA, are anticipated as a result of habitat restoration activities because of the beneficial effects of enhanced scenic and visual qualities.

VAFB would address the Proposed Action with California Coastal Commission staff and request concurrence with a Consistency Determination or Negative Determination, as appropriate.

4.6.2 Alternative B: No-Action Alternative

Under this Alternative, restoration of natural coastal strand and foredune communities at selected sites on VAFB would not occur. Visual complexity within these areas would continue to decrease as invasive species continue to spread, open sand areas would continue to stabilize, and vegetative succession would continue to advance.

4.6.3 Alternative C

As with the Proposed Action (section 4.6.1), no adverse effects would result from this Alternative. Similar beneficial effects of enhanced scenic and visual qualities would occur under Alternative C, except that the area affected would be 434 acres (versus 440 acres under the Proposed Action). California Coastal Commission concurrence with a Consistency Determination or Negative Determination would be required under Alternative C.

4.7 Water Resources

Adverse impacts to water resources would occur if the Proposed Action: caused substantial flooding or erosion; adversely affected surface water quality to creeks or rivers, streams, lakes, or bays; or adversely affected surface or groundwater quality or quantity.

4.7.1 Alternative A: Proposed Action

The Proposed Action would require coverage under the NPDES Construction General Permit because the total disturbed area of the Proposed Action would be greater than one acre. A Storm Water Pollution Prevention Plan (SWPPP) would be developed and implemented to maintain compliance with the NPDES Construction General Permit. All permit conditions and best management practices (BMPs) would be implemented to minimize the potential for adverse impacts to local water resources.

A Notice of Intent would be submitted to the State Regional Water Control Board. A Notice of Termination would be submitted to the Central Coast RWQCB to ensure all permit termination requirements are met. The Notice of Intent and Notice of Termination would be coordinated with 30 CES/CEV and signed by 30th Civil Engineer Squadron, Commander or Deputy Commander prior to submittal.

A CWA Section 401 Water Quality Certification from the Central Coast RWQCB and CWA Section 404 Permit from the U.S. Army Corps of Engineers would not be required under the Proposed Action because no direct impacts to water bodies or wetlands would occur. There are no direct discharges from the Proposed Action into any of the CWA Section 303 (d) listed water bodies (San Antonio Creek, and Santa Ynez River) on VAFB.

Surface Water and Floodplains

Glyphosate, and common surfactants used with glyphosate, are strongly absorbed by soil particles. Glyphosate does not have herbicidal properties once it comes in contact with soil (U.S. EPA 1993). Degradation in the fine to medium grain sand, with low organic content found throughout the project areas, is expected to be slow. Glyphosate and surfactants absorbed by soil particles are not easily released back into water moving through the soil, and the potential for leaching is low (U.S. EPA 1993). Any glyphosate in the soil would be expected to be transported westerly towards the ocean as that is the prevailing direction of drainage within the project areas.

The use of herbicides and POLs pose the potential for releasing pollutants and adversely affecting water resources. This potential would be greatest during the rainy season. Proper management of materials and wastes during restoration activities would reduce or eliminate the potential for contaminated runoff.

As required by the NPDES Construction General Permit, BMPs would be implemented to properly manage materials. Implementing BMPs as part of the NPDES Construction General Permit to reduce and/or eliminate project-associated runoff would further reduce the potential for adverse effects, especially during the rainy season.

Removal of invasive plant species is expected to increase wind blown sand movement within the project areas. However, the prevailing wind direction pattern on VAFB is from the north and northwest throughout the year. Sand movement into San Antonio Creek and the Santa Ynez River, which are located north of the project areas, is not anticipated to occur.

With Environmental Protection and Monitoring Measures (Section 4.7.2) in place, adverse effects to surface water and floodplains would be less than significant.

4.7.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Water Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented

- Compliance with NPDES Construction General Permit conditions should minimize potential adverse impacts to water resources. A SWPPP, approved by 30 CES/CEV, would be developed and implemented prior to initiation of any activities under the Proposed Action.

In addition, implementation of the measures described below should further reduce the potential for adverse effects to water resources:

- BMPs, including proper spill prevention practices for all stored liquids and construction vehicles, would be implemented to prevent chemicals from entering storm water.

- Proper management of hazardous materials and wastes during restoration activities would reduce or eliminate the potential for contaminated runoff.

4.7.3 Alternative B: No-Action Alternative

Under the No-Action Alternative, restoration activities would not occur, therefore there would be no effects on Water Resources at VAFB.

4.7.4 Alternative C

The same environmental consequences would result under Alternative C as described under the Proposed Action. Implementation of the environmental protection and monitoring measures described under Section 4.7.2 should avert adverse effects.

4.8 Cumulative Impacts

Adverse cumulative impacts (hereinafter referred to as "cumulative impacts") result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes these other actions. Cumulative impacts can result from actions whose adverse impacts are individually minor or negligible, but collectively significant over a period of time.

No other significant actions are planned or have occurred over the past 5 years within snowy plover breeding habitat on VAFB that would result in a cumulative impact when considered in conjunction with the Proposed Action or alternatives. The Air Force is presently conducting eradication of jubata grass (*Cortaderia jubata*) on VAFB; however, areas targeted for removal do not occur within the proposed habitat restoration areas. The VAFB HazMart maintains basewide usage and emissions reports of hazardous materials, including herbicides, as required by federal, state, and local environmental regulations. Inaddition, comprehensive site evaluation activities are being conducted under the Military Munitions Response Program to characterize munitions response areas. Activities within snowy plover breeding habitat were deemed to have the potential to affect snowy plovers. However, because these activities occurred outside the breeding season (March 1 to September 30), no adverse effects resulted. A USFWS approved biologist was present to minimize adverse effects to wintering snowy plovers.

Application of fire treatments would be in accordance with all state and local policies and procedures. A Burn Plan would be developed and submitted to the SBCAPCD as part of the VAFB Prescribed Fire Plan for 2008. Emissions resulting from fire treatments under the Proposed Action would be considered in conjunction with other planned prescribed fire on VAFB and proper planning would minimize cumulative effects to air quality.

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Chapter 5. Persons and Agencies Contacted

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Dave Savinsky, Air Quality, 30 CES/CEV, VAFB
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Chapter 6. List of Preparers

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Years of Experience: 8

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Years of Experience: 7

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M.S. 1999 Biological Sciences, California Polytechnic State University, San Luis Obispo
Years of Experience: 13

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B.S. 1974 Sociology with Archaeology emphasis, Montana State University, Bozeman
M.A. 1977 Anthropology, University of Wyoming, Laramie
Years Experience: 30

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Chapter 7. Distribution List

California Coastal Commission, Federal Consistency Review, San Francisco, CA
California Native Plant Society, Los Osos, CA
California Regional Water Quality Control Board, Central Coast Region, San Luis Obispo, CA
Defense Technical Information Center (World Wide Web http://www.dtic.mil)
Environmental Defense Center, Santa Barbara, CA
La Purisima Audubon Society, Lompoc, CA
Santa Barbara County Air Pollution Control District, Project Review, Santa Barbara, CA
Santa Barbara Museum of Natural History, Santa Barbara, CA
Santa Ynez Band of Chumash Indians, Office of the Tribal Chairman, Santa Ynez, CA
U.S. Fish and Wildlife Service, Ventura Field Office, Ventura, CA
University of California, Museum of Systematics & Ecology, Santa Barbara, CA
Lompoc Public Library, Lompoc, CA
Santa Barbara Public Library, Santa Barbara, CA
Santa Maria Public Library, Santa Maria, CA
University of California, Library, Santa Barbara, CA
VAFB Library, VAFB, CA

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Chapter 8. Bibliography

Aptekar, R. 1999. The ecology and control of European beachgrass (*Ammophila arenaria*). Ph.D. dissertation, University of California, Davis.

Arnold, R.A. 1983. Ecological studies of six Endangered butterflies (Lepidoptera, Lycaenidae): Island biogeography, patch dynamics, and the design of habitat preserves. Univ. Calif. Pub. Entomol. 99:1-161.

Barbour, M.G. and A.F. Johnson. 1988. Beach and dune. In: Barbour, M.G. and J. Major (eds.). Terrestrial Vegetation of California. John Wiley & Sons, New York, NY.

Barbour, M.G. and J. Major. 1990. Terrestrial vegetation of California. California Native Plant Society. Special Publication Number 9, University of California, Davis. 1028 pp.

Bossard, C.C., J.M. Randall, and M.C. Hoshovsky (eds.). 2000. Invasive Plants of California's Wildlands. University of California Press. Berkeley. 360 pp.

Brewster, D.W., J. Warren, and W.E. Hopkins. 1991. Metabolism of Glyphosate in Sprague-Dawley Rate: Tissue Distribution, Identification, and Quantitation of Glyphosate-Derived Materials Following a Single-Oral Dose. Fundamental and Applied Toxicology 17: 43-51.

Brown, R.S. 1984. Archaeological Site Displacement in Dunes. Master's thesis, on file, 30 CES/CEVPC, Vandenberg Air Force Base, California.

Carbone, L.A., and R.D. Mason. 1998. Phase I, II, and III Archaeological Surveys for Cultural Resources Inventory, Vandenberg Air Force Base, Santa Barbara County, California. Science Applications International Corporation and Chambers Group, Inc., Santa Barbara, California. Submitted to U.S. Department of the Interior, National Park Service, Western Region Interagency Archeological Services Branch, San Francisco. (VAFB-1998-03).

CDFG. 1999. Special Status Plants, Animals and Natural Communities of Santa Barbara County. California Natural Diversity Data Base.

CDFG. 2001. Special Plants and Animals: Casmalia USGS Quadrangle. California Natural Diversity Database.

CDFG. 2007a. Special Animals. Department of Fish and Game Wildlife and Habitat Analysis Branch. California Natural Diversity Database. Retrieved from the World Wide Web: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf.

CDFG. 2007b. Special Vascular Plants, Bryophytes, and Lichens List. Department of Fish and Game Wildlife and Habitat Analysis Branch. California Natural Diversity Database. Retrieved from the World Wide Web: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPPlants.pdf.

Christopher, S.V. 1996. Reptiles and amphibians of Vandenberg AFB, Santa Barbara County, California. Museum of Systematics and Ecology, Report No. 4, University of California, Santa Barbara, in cooperation with the National Biological Service, San Simeon.

Christopher, S.V. 2002. Sensitive amphibian inventory at Vandenberg Air Force Base, Santa Barbara County, California. Summary of preliminary results and site maps. Appendix A Field survey data January 1995 through March 2002.

Clark, M.E. 1997. Archaeological Surveys around Septic Systems at Various Facilities, Vandenberg Air Force Base, Santa Barbara County, California. Tetra Tech, Inc., Santa Barbara, California, and Applied EarthWorks, Inc., Fresno, California. Submitted to 30 CES/CEV, Vandenberg Air Force Base, California, USAF Contract No. F04684-95-C-0045, Work Request No. 1.

Coleman, D.M., and C.G. Lebow. 2004. Cultural Resources Condition on Vandenberg Air Force Base, Fiscal Year 2002: Zones 1 and 2. Applied EarthWorks, Inc., Lompoc, California. Submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California.

Cooper, W.S. 1967. Coastal sand dunes of California. Geological Society of America. 104:1-131.

Costermans, L. 1981. Native trees and shrubs of south-eastern Australia. Rigby Publishers Ltd.

Coulombe, H.N., and C.F. Cooper. 1976. Ecological Assessment of Vandenberg AFB, California. Volume 1, Evaluation and Recommendations. AFCEC-TR-76-15. Center for Regional Environmental Studies, San Diego State University, San Diego, California.

Coulombe, H.N., and C.R. Mahrdt. 1976. Ecological Assessment of Vandenberg Air Force Base, California. Vol II: Biological inventory, 1974/75. Prepared for Headquarters Space and Missile Systems Org., Air Force Systems Command, Los Angeles Air Force Station, California.

D'Antonio, C.M. 1990a. Invasion of coastal plant communities in California by the introduced iceplant, *Carpobrotus edulis* (Aizoaceas). Ph.D. dissertation, University of California, Santa Barbara.

D'Antonio, C.M. 1990b. Seed production and dispersal in the non-native, invasive succulent *Carpobrotus edulis* in coastal strand communities of central California. J. Applied Ecology. 27:693-702.

Dennill, G.B., D. Donnelly, and S.L. Chown. 1993. Expansion of host-plant range of a biocontrol agent *Trichilogaster acaciaelongifoliae* (Pteromalidae) released against the weed *Acacia longifolia* in South Africa. Agric. Ecosystems Environ., 43:1-10.

Erlandson, J.M. 1984. Early Hunter-Gatherers of the California Coast. Plenum, New York.

Gibson, R.O. 1984. Results of Archaeological Surface Survey for the PAPI Runway Landing Lights Vandenberg Air Force Base, CA. Letter report submitted to Parsons Engineering. On file with 30 CES/CEV, Vandenberg Air Force Base, California.

Gibson, R.O. 1985a. Results of Archaeological Monitoring and Limited Subsurface Testing for the V-23 Space Shuttle Launch Site Patrol Roads C and D, Vandenberg Air Force Base, California On file with 30 CES/CEV, Vandenberg Air Force Base, California.

Gibson, R.O. 1985b. Summary of Archaeological Monitoring for the Northern and Southern Mitigating Routes for the Union Oil Pipeline, Vandenberg Air Force Base, California. On file, 30 CES/CEVPC, Vandenberg Air Force Base, California.

Gibson, R.O., and J.A. Parsons. 2002. Results of Presence/Absence testing for Cultural Resources at SBA-912, SBA-1040, SBA-1131, SBA-1146, SBA-1889, SBA 2880, and SBA-2953 Vandenberg Air Force Base. Santa Barbara County, CA. Submitted to 30 CES/CEV, Vandenberg Air Force Base, California.

Glassow, M.A. 1990. Archaeological Investigations on Vandenberg Air Force Base in Connection with the Development of Space Transportation System Facilities, with contributions by Jeanne E. Arnold, G. A. Batchelder, Richard T. Fitzgerald, Brian K. Glenn, D. A. Guthrie, Donald L. Johnson, and Phillip L. Walker. Department of Anthropology, University of

California, Santa Barbara. Submitted to U.S. Department of the Interior, National Park Service, Western Region Interagency Archeological Services Branch, San Francisco, Contract No. CX-8099-2-0004.

Glassow, M.A., J.E. Arnold, G.A. Batchelder, R.T. Fitzgerald, B.K. Glenn, D.A. Guthrie, D.L. Johnson, and P.L. Walker. 1981. Preliminary Report: Archaeological Data Recovery Program in Relation to Space Shuttle Development, Vandenberg Air Force Base, California. Submitted to Heritage Conservation and Recreation Service, Interagency Archeological Services, San Francisco, Contract No. C-2501(79).

Glassow, M.A., L.W. Spanne, and J. Quilter. 1976. Evaluation of Archaeological Sites on Vandenberg Air Force Base, Santa Barbara County, California. Department of Anthropology, University of California, Santa Barbara. Submitted to the U.S. Department of the Interior, National Park Service, Office of Archaeology, San Francisco, Contract No. CX800040020.

Hickman, J.C. (ed.). 1993. The Jepson Manual. Higher plants of California. University of California Press, Berkeley. 1400 pp.

Holland, R.F. 1986. Preliminary descriptions of the Terrestrial Natural Communities of California. Nongame Heritage Program. California Department of Fish and Game. Sacramento.

Holmgren, M.A., and P.W. Collins. 1999. Final report on the distribution and habitat associations of six bird species of special concern at Vandenberg Air Force Base, Santa Barbara County, California. Prepared for Vandenberg Air Force Base, 30CES/CEVPN, Natural Resources, Vandenberg Air Force Base, California. Santa Barbara Museum of Natural History Monographs No. 1, Studies in Biodiversity No. 1. 204 pp.

Huiskes, A.H. 1979. Biological flora of the British Isles: *Ammophila arenaria* (L.) Link. J. of Ecology. 67:363-82.

Jaffke, T.D. 1990. Archaeology Survey Report, Waterline Replacement on South Vandenberg Air Force Base, California. Submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California.

Keil, D.J., and V.L. Holland. 1998. Documented Flora of Vandenberg Air Force Base, Santa Barbara County, California. California Polytechnic State University, San Luis Obispo.

King, C.D., R.O. Gibson, J. Hunter, M.K. Martin, L. Roberts, and L.R. Wilcoxon. 1985. Cultural Resources. In Union Oil Project/Exxon Project Shamrock and Central Santa Maria Basin Area Study EIS/EIR, Technical Appendix G. Arthur D. Little, Inc., Santa Barbara, California. Prepared for County of Santa Barbara U.S. Minerals Management Service, California State Lands Commission, and California Office of Offshore Development.

Lebow, C.G. 2000. Collection and Management of Radiocarbon Data during Fiscal Year 2000, Vandenberg Air Force Base, Santa Barbara County, California. Applied EarthWorks, Inc., Fresno, California, for Tetra Tech, Inc., Santa Barbara, California. Submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California, USAF Contract No. F04684-95-C-0045.

Lebow. C.G. 2004. Archaeological Studies for the Encapsulated Payload Transfer Route, Vandenberg Air Force Base, Santa Barbara County, California. Applied EarthWorks, Inc., Lompoc, California. Submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California.

Lebow, C.G., and D.M. Ryan. 2006. Archaeological Survey of the Coastline and Lower Drainages, Vandenberg Air Force Base, Santa Barbara County, California. Applied EarthWorks, Inc.,

Lompoc, California. Submitted to 30th Civil Engineer Squadron, Environmental Flight, Cultural Resources Section (30 CES/CEVNC), Vandenberg Air Force Base, California.

Lehman, P.E. 1994. The birds of Santa Barbara County, California. Vertebrate Museum, University of California, Santa Barbara. 337 pp.

Martin Marietta Corporation. 1985. Environmental Surveillance Report, No. 20, October 1, 1984 through August 15, 1985. On file, 30 CES/CEVPC, Vandenberg Air Force Base, California. Filed on a separate shelf for surveillance reports.

Mattoni 1992. The endangered ESBB. J. Res. Lep. 29:277-304.

MSRS, R. Arnold, and G. Pratt. 2008. El Segundo Blue Butterfly (*Euphilotes battoides allyni)*: Flight Season Surveys. Vandenberg AFB, California. January 2008. 24 pp.

Page, G.W., and L.E. Stenzel (eds.). 1981. The breeding status of the snowy plover in California. Western Birds 12(1):1-40.

Page, G.W., and P.E. Persons. 1995. The snowy plover at Vandenberg Air Force Base: Population size, reproductive success, and management. Unpublished Report, Stinson Beach, CA. 29 pp.

Palacios, E., L. Alfaro, and G.W. Page. 1994. Distribution and abundance of breeding snowy plovers on the Pacific Coast of Baja, California. J Field Ornith. 65:490-497.

Peterson, R., J.D. Moore, and R.H. Colten. 1984. Phase I Archaeological Survey of a Proposed Powerline Right-of-Way and Two Alternative Pipeline Routes, Lompoc, California. On file, Central Coast Information Center, California Historical Resources Information System, University of California, Santa Barbara.

Peterson, R.R., C.G. Lebow, and K. Osland. 2008. Archaeological Survey Report and Avoidance Plan for the Snowy Plover Habitat Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California. Applied Earthworks, Inc., Lompoc, California. Submitted to 30 CES/CEVNC, Vandenberg Air Force Base, California.

Pickart, A.J. 1997. Control of European Beachgrass (*Ammophila arenaria*) on the West Coast of the United States. 1997 Symposium Proceedings for the California Exotic Pest Plant Council. 8 pp.

Ruth, C. 1967. A Survey of Fifty Prehistoric Chumash Indian Village Sites, 1930–1967. Manuscript on file, Department of Anthropology, University of California, Santa Barbara and Lompoc Museum, Lompoc, California.

Schmalzer, P.A., and C.R. Hinkle. 1987. Monitoring biological impacts of space shuttle launches from Vandenberg Air Force Base: Establishment of baseline conditions. NASA Technical Memorandum 100982. Prepared by Bionetics Corporation, John F. Kennedy Space Center, Florida.

Schmalzer, P.A., D.E. Hickson, and C.R. Hinkle. 1988. Vegetation Studies on Vandenberg Air Force Base, California. NASA Technical Memorandum 100985, The Bionetics Corporation, John F. Kennedy Space Center, Florida. March, 1988. 461 pp.

Spanne, L.W. 1974. Archaeological Survey of Vandenberg Air Force Base, Santa Barbara County, California 1971–1973. University of California, Santa Barbara. Submitted to U.S. Department of the Interior, National Park Service, San Francisco, Contract No. NPS-4970P11194.

Spanne, L.W., and M.A. Glassow. 1974. Air Force Space Transportation System, Vandenberg AFB, Santa Barbara County, California, Testing and Evaluation of Archaeological Sites: A Preliminary Report. University of California, Santa Barbara.

SRS. 2005. Final Plan for the Removal of Selected Invasive Plants from Western Snowy Plover Habitat at Vandenberg Air Force Base. April 2005. 64 pp.

SRS. 2006. Special-status Crustacean Surveys at Vandenberg Air Force Base, Santa Barbara County, California, November 2004-April 2006. 23 October. 20 pp.

SRS. 2007. Survey Results for Three Federally Endangered Plants on Vandenberg Air Force Base, California. 1 November, 2007. 43 pp. plus Appendix.

Tetra Tech, Inc. 1988. Historic Preservation Plan, San Antonio Terrace National Register District, Vandenberg Air Force Base, California. Tetra Tech, Inc., San Bernardino, California. Prepared for United States Air Force AFRCE-BMS, Norton Air Force Base, California.

USAF. 1998. Final environmental assessment for installation of Tranquillion Mountain fiber-optic cable system, Vandenberg Air Force Base, California.

U.S. EPA. 1993. Reregistration Eligibility Decision: Glyphosate (EPA-738-R-93-014). Washington D.C. September 1993.

USFWS. 1993. Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover. 58 FR 12864. March 5, 1993.

USFWS. 1995. European Beach Grass Surveys Within Western Snowy Plover Nesting Habitat At Vandenberg Air Force Base, Santa Barbara County, California. Prepared for U.S. Air Force Vandenberg Air Force Base, 19 October 1995. Prepared by Laye, D., and L. Mangione of the U.S. Fish and Wildlife Service, Ecological Services, Ventura Field Office.

USFWS. 2001a. Biological Opinion for Beach Management and the Western Snowy Plover on Vandenberg Air Force Base for the 2001 Breeding Season (1-8-01-F-13). March 9, 2001.

USFWS. 2001b. Biological Opinion for Beach Management and the Western Snowy Plover on Vandenberg Air Force Base for the 2002 Breeding Season (1-8-02-F-7). December 21, 2001.

USFWS. 2003. Biological Opinion for Beach Management for the Western Snowy Plover on Vandenberg Air Force Base for the 2003 Breeding Season (1-8-03-F-13). May 12, 2003.

USFWS. 2005. Biological Opinion for Beach Management for the Western Snowy Plover on Vandenberg Air Force Base for the 2005-2009 Breeding Seasons (1-8-05-F-5R). March 1, 2005.

USFWS. 2007a. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). California/Nevada Operations Office, Sacramento, California. 751 pp. plus Appendices.

USFWS. 2007b. Concurrence for Beach Restoration Activities Supporting Biological Opinion (1-8-05-F-5R) for Western Snowy Plover. December 19, 2007.

USFWS. 2008. Endangered and Threatened Wildlife and Plants: 12-Month Petition Finding and Proposed Rule to Remove the Brown Pelican (*Pelecanus occidentalis*) from the Federal List of Endangered and Threatened Wildlife; Proposed Rule. Federal Register Volume 73, Number 34. February 20.

VAFB. *In Progress*. Preliminary Draft Integrated Natural Resources Management Plan, Vandenberg Air Force Base, California.

VAFB. 2007. Vandenberg Air Force Base General Plan.

WESTEC Services, Inc. 1981. Geophysical Evaluation, Vandenberg Air Force Base, Santa Barbara County, California, for Union Oil Company of California. WESTEC Services, Inc., Tustin, California. Submitted to Union Oil Company, Ventura, California.

Wiedemann, A.M., and A.J. Pickart. 1996. The Ammophila problem on the Northwest coast of North America. Landscape and Urban Planning 34:287-299.

Wiedemann, A.M., L.J. Dennis, And F.H. Smith. 1969. Plants of the Oregon coastal dunes. Department of Botany, Oregon State University. Oregon State University Book Stores, Inc., Corvallis, OR. 117 pp.

APPENDIX A

Final Plan for the Removal of Selected Invasive Plants from Western Snowy Plover Habitat at Vandenberg Air Force Base

FINAL PLAN FOR THE REMOVAL OF SELECTED INVASIVE PLANTS FROM WESTERN SNOWY PLOVER HABITAT AT VANDENBERG AIR FORCE BASE

Prepared by:

SRS TECHNOLOGIES

APRIL 2005

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INTRODUCTION

As a part of Vandenberg Air Force Base's (VAFB) snowy plover management strategy, the United States Air Force (USAF) proposed to eradicate non-native dune vegetation to offset the adverse effects of allowing for recreational access to 1.25 miles of western snowy plover (*Charadrius alexandrinus nivosus*) critical habitat (USAF 2000). The activities involved in the eradication of non-native dune vegetation are to be detailed in an "eradication plan", as described in U.S Fish and Wildlife Service (USFWS) Biological Opinion (1-8-01-F-13), dated 9 March 2001. Per the Biological Opinion, project elements are to include: 1) removal of European beachgrass (*Ammophila arenaria)* and iceplant (*Carpobrotus* spp.); 2) revegetation with native dune species; and 3) annual maintenance, as needed, to prevent re-establishment of non-native species. The Biological Opinion recommends that eradication be accomplished while ensuring minimal disturbance to nesting western snowy plovers (hereinafter referred to as "plover").

PROJECT GOAL AND OBJECTIVES

The need for this project arises from 1) the continued degradation of plover critical habitat on VAFB due to the increasing area that is being invaded by exotic plant species and 2) VAFB's Environmental Flight's desire to address the recommendations contained in the Biological Opinion, as described above. "Habitat" in this document is meant to refer to "the resources and conditions present in an area that produce occupancy – including survival and reproduction – by a given organism" (Hall et al. 1997). Habitat quality, as explained in Hall et al. 1997, refers to the "ability of the environment to provide conditions appropriate for individual and population persistence." Critical habitat, as defined by the USFWS, is further described later in this document.

The goal of the proposed project is to increase the amount of quality breeding habitat available to plovers in areas on VAFB designated as plover critical habitat, and to minimize impacts to the species while doing so. This project proposes to accomplish this goal by reducing the amount of European beachgrass and iceplant in selected areas on VAFB. When appropriate, invasive species removal would be followed by revegetation with native plant species.

The proposed project would be considered successful if the following objectives are met with minimal disturbance to plovers:

- Targeted invasive species are removed from or minimized in selected areas within 5 years of project initiation.
- Selected areas are restored/modified to possess the dune structure and native plant composition characteristic of historic plover nesting habitat on VAFB and habitat as described in USFWS (1999), *Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover*.
- Selected areas are monitored and maintained free of targeted invasive species, and no infestation of new exotic species occurs during the 5 years of active restoration activity.
- Western snowy plovers use the restored/improved habitat for nesting or rearing their young within 5 years of completion of the active restoration activity.

- Within 10 years of project initiation, hatch success in the restored areas is determined to be comparable or better than adjacent plover nesting areas that have not been restored.

THREATENED WESTERN SNOWY PLOVER AND CRITICAL HABITAT DESIGNATION

The western snowy plover is a small shorebird that weighs between 1.2 and 2.0 ounces (Page et al., 1995). Western snowy plover coloring is described as being a pale gray-brown above and white below, with dark lateral patches on either side of the upper breast, and with blackish legs and bill (USFWS 2001a). The Pacific coast breeding population of plovers was listed as threatened under the Endangered Species Act on 5 March 1993 by the USFWS.

Plover nesting season typically runs from mid-March to mid-September and coincides with the period of greatest human use of the beaches on the west coast of North America. On VAFB, plover nesting season officially begins on 1 March and concludes on 31 September. Plovers typically nest in flat, open areas with sandy or saline substrates, and where vegetation and driftwood are described as being sparse or absent (Widrig 1980, Wilson 1980, Stenzel et al. 1981).

Declines in active nesting areas and the size of breeding and wintering populations have been attributed to habitat degradation. Habitat degradation is further described as a result of human disturbance, urban development, introduced beachgrass (*Ammophila spp.*), and expansion of predator populations (USFWS 2001a).

European beachgrass was regarded as a "major dune plant" in approximately 50 percent of all California plover breeding sites by 1988 (J.P. Myers, National Audubon Society, in lit. 1988). It was also noted that European beachgrass reduced the amount of unvegetated area above the tide line, decreased the width of the beach, and increased the slope of the beach - all of which contribute to a reduction in the amount of potential plover nesting habitat (USFWS 2001a).

On 7 December 1999, the final rule designating critical habitat for the plover was published in the Federal Register. Critical habitat designation identifies areas essential for the conservation of the species, as well as areas that may require special management or protection. The Endangered Species Act defines critical habitat as "specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management consideration or protection and; (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species" (USFWS 1999).

Of the 28 areas designated as critical habitat for plovers, 19 were proposed in California, and two of these units occur on VAFB. The first unit encompasses Minuteman Beach, Shuman Beach, San Antonio Beach, pocket beaches north of Purisima Point, and Purisima Point (Figure 1). The second unit includes Wall Beach and Ocean Beach (also known as Surf Beach) (Figure 2). A 1995 study concluded that VAFB has supported as much as 22 percent of the California snowy plover coastal breeding population (Page and Persons 1995); this is an indication that VAFB is important to the recovery of the species.

Powell, et al. (1995, 1996) found that in southern California, plovers nested in areas with 6 to 18 percent vegetative cover and 1 to 14 percent inorganic cover. They also noted that vegetation was usually less than 2.4 inches tall. Page and Stenzel (1981) found that nests were usually within 328 feet or 100 meters of water, but could be up to several hundred meters away if no vegetative barrier was present between the nest and water. Powell, et al. (1995, 1996) similarly found that nests in southern California were frequently found within 328 feet or 100 meters of water, and that this water could be an ocean, lagoon, or river mouth. Laye and Mangione (USFWS 1995) characterized suitable nesting habitat on VAFB as "…large open, sandy areas within a quarter of a mile (400 meters) of the shoreline with unobstructed ground access to the water and scattered pieces of vegetation and/or detritus." They also note vegetation is not absent from these areas, but is widely scattered.

Although some VAFB beaches are wide, with open sand dunes extending up to 1 mile inland, most nests are concentrated within 984 feet (300 meters) from the shoreline. Monitoring data at VAFB from 1994 through 1999 show that 98.9 percent of nests were established within 984 feet or 300 meters (USAF 2000) of the shoreline. Likewise, monitoring data from 2001 through 2003, indicate that the vast majority of nests fell within this 300-meter line (PRBO 2001, SRS Technologies 2002a, 2003).

Figure 1. Western snowy plover critical habitat on north Vandenberg AFB.

Figure 2. Western snowy plover critical habitat on south Vandenberg AFB.

TARGETED INVASIVE PLANT SPECIES IN WESTERN SNOWY PLOVER HABITAT ON VANDENBERG AIR FORCE BASE

The terms "exotic," "non-native," "non-indigenous," and "alien" all refer to species that have been introduced either intentionally or accidentally into a region where they do not naturally occur. An invasive plant species, for the purposes of this plan, is defined as one of these species that is not native to the area, does not have a natural control to limit its reproduction and spread, and tends to out-compete or over cover regional native species, sometimes to the point of exclusion.

The quality and extent of plover breeding habitat on VAFB is being degraded by the invasion of non-native plant species. Additionally, these invasive species are often degrading habitat by excluding native plant species as they spread. The two most invasive species in the plover breeding areas on VAFB are European beachgrass and iceplant. European beachgrass forms dense stands, and can dramatically alter dune structure through sand accumulation. European beachgrass encroachment was identified as being "one of the most significant causes of habitat loss for coastal breeding snowy plover" (USFWS 2001a). Iceplant forms dense mats and has the potential to alter dune structure, although to a lesser degree than beachgrass. The effects of both these species, forming dense monotypic stands of vegetation, result in unfavorable nesting conditions for the plover. Therefore, these invasive plant species have been targeted for removal from selected areas of VAFB plover habitat based on their effect on natural communities.

European beachgrass (*Ammophila arenaria*)

"European beachgrass is the most pervasive exotic plant species currently threatening coastal dunes on the west coast of the U.S. *Ammophila* is invasive in every major dune system from Santa Barbara County, CA, to the northernmost dunes of Washington" (Pickart 1997). European beachgrass (Figure 3) is a perennial grass that occurs in coastal dunes with clumped, stiff, upright stems. Native to the coast of Europe and North Africa, it was first planted in 1869 on the Pacific Coast near San Francisco's Golden Gate Park (Bossard et al 2000). It was later used extensively on the west coast to stabilize sand dunes.

European beachgrass spreads almost exclusively by rhizomes, and rarely establishes by seed (Bossard et al 2000). These rhizomes grow very quickly; in six months, they can extend laterally over 6.5 feet (two meters) (Aptekar 1999). Shoots grow vigorously in spring with growth slowing, but not stopping, in winter (Huiskes 1979). At VAFB, active growth would be expected to occur mainly from February through June, based on amount of available daylight and moisture. Beachgrass grows most vigorously with continuous sand accretion and can form expansive monospecific stands (Bossard 2000). Expansion rate can also be affected by environmental conditions such as rainfall and plant community dynamics (USFWS 1995).

Figure 3. A stand of European beachgrass near western snowy plover critical habitat on north Vandenberg AFB.

Through sand accretion, European beachgrass can drastically change beach topography. It creates steep foredunes and alters dune formation to run parallel to the coast. Native grasses promote dunes running almost perpendicular to the coast (Cooper 1967, Barbour and Johnson 1988, Wiedemann and Pickart 1996). Vegetated foredunes, dominated by beachgrass, also effectively block sand from moving inland. This creates favorable conditions for dense vegetation to establish itself in the deflation plain behind the foredunes (Wiedemann et al. 1969) and as such, the open features characteristic of plover breeding habitats are destroyed (USFWS 2001a).

European beachgrass is known to form a dense cover that can prevent native plant species from becoming established in these areas. Beaches dominated by beachgrass have shown vegetative species richness that is half of what is present on foredunes dominated by native dune grass (Barbour and Major 1990). Native dune plants do not bind sand in the same manner as beachgrass; therefore sand movement and regeneration of open expanses of sand is possible with these species (USFWS 2001a). The stabilization of sand by beachgrass allows plant and animal species, which are normally found further inland in the coastal dune scrub, to become established nearer to the coastal strand.

Laye and Mangione (USFWS 1995) report that many areas on VAFB show "total domination of historic habitat" and note that beachgrass has reduced the width and slope of beach habitat south of Ocean Beach, which was previously broader and more gently sloped. In addition, beachgrass may provide habitat for plover predators that might not have used the beach without the additional cover provided (USFWS 1993). Potential predators could include weasels, skunk, coyote, loggerhead shrike, and other birds of prey. Increased predation could reduce breeding success.

Pickart (1997) stresses that, as with any exotic plant infestation, it is critical to prevent expansion of beachgrass into any new, pristine areas, and that this principle is applicable at both local and regional levels.

Iceplant (*Carpobrotus ssp.*)

Highway iceplant (*Carpobrotus edulis)*, native to coastal areas of South Africa, is a perennial ground-hugging succulent that often forms deep mats that cover large areas (Bossard 2000). Starting in the early 1900s, highway iceplant was used in California to stabilize soil along railroad tracks; by the 1970s thousands of acres had been planted for similar purposes (Bossard 2000).

Highway iceplant can reproduce vegetatively and by seed. Active growth appears to occur year round and D'Antonio (1990b) reports that individual shoot segments can grow more than 3.3 feet (1 meter) per year. In California, flowering occurs throughout the year and flowers are described as being yellow or light pink (Bossard 2000). Fruits, which mature on the plant, are eaten by mammals such as deer and rabbits and pass through their digestive system, enhancing germination (Bossard 2000). Iceplant easily spreads to pristine areas via mammals (D'Antonio 1990a).

Highway iceplant and its close relative, sea fig (*Carpobrotus chilensis*), readily hybridize throughout their range in California (Bossard 2000), including on VAFB (Figure 4). Sea fig is described to be more diminutive and less aggressive than highway iceplant, and to have smaller flowers that are deep magenta (Bossard 2000). Due to the commonness of hybridization, both species and hybridized individuals will hereafter be referred to as iceplant.

Figure 4. Highway iceplant and sea fig on Vandenberg AFB.

Individual branch segments of iceplant can survive, even when isolated from the rest of the plant, because it can produce roots from every node. For this reason, even shoot segments can propagate (Bossard 2000). This accounts for the density of iceplant stands, and the ability of the plant to accumulate sand at a higher rate than native dune plants.

Iceplant can indirectly affect the communities it invades by building up organic matter in normally sandy beach and dune soils, which can result in invasion by non-native plants that normally would not be able to establish in sandy soils (Bossard 2000). Iceplant can also contribute to the stabilization of dune sands, changing the natural dune community processes

over time (Bossard 2000). These factors make iceplant capable of changing the physical composition and the quality of plover habitat.

OTHER THREATENED/ENDANGERED AND SPECIAL STATUS SPECIES

Special Status, Rare, and Listed Plant Species

Snowy plover habitat on VAFB includes three main types of vegetation communities: coastal strand and foredunes, coastal dune scrub, and coastal salt marsh (USAF 2000, 2003). This project's activities would occur mainly in the coastal strand and foredune community, however some activities could potentially occur where this community grades into coastal dune scrub. Several special status plant species and one endangered plant species occur within these two communities. A listing of all of VAFB's special status, rare and listed plant species, along with their status and occurrence on VAFB is available in the Final Draft Integrated Natural Resources Management Plan for Vandenberg Air Force Base California (USAF 2003). It is likely that the removal of exotic vegetation associated with this project would result in beneficial effects for special status plant species on VAFB, in addition to the benefits to snowy plovers[1].

Coastal Dune Scrub

As stated above, project activities would not be expected to impact special status species in coastal dune scrub, as activities would mainly occur in coastal strand and foredunes. However, as some activity may occur near or adjacent to the dune scrub community, the following information is provided.

Sensitive species recorded at VAFB in the coastal dune scrub include species such as the straight-awned spineflower (*Chorizanthe rectispina*), seaside bird's beak (*Cordylanthus rigidus ssp. littoralis*), Blochman's larkspur (*Delphinium parryi ssp. blochmaniae*), Blochman's fleabane daisy (*Erigeron blochmaiae*), San Luis Obispo wallflower (*Erysimum capitatum ssp. lompocense*), suffrutescent wallflower (*Erysimum insulare ssp. suffrutescens*), beach layia, crisp monardella (*Monardella crispa*), San Luis Obispo monardella (*Monardella frutescens*), California spineflower (*Mucronea californica*), Michaelis rein orchid (*Piperia michaelii*) and black-flowered figwort (*Scrophularia atrata*) (Keil and Holland 1998).

Coastal Strand and Foredunes

Project activities would occur in VAFB's coastal strand and foredunes. On VAFB, several special status or rare plants occur in the strand and foredune plant community. These include surf thistle *(Cirsium rhothophilum*), beach spectacle pod (*Dithyrea maritima*), beach layia (*Layia carnosa*), and dune dandelion (*Malacothrix incana*) (Keil and Holland 1998). Information on listed species is included below.

[1]Gillespie, C., pers. comm., VAFB Botanist, 2003.

Surf thistle. Surf thistle is not listed federally but was listed by the State of California as threatened in February of 1990, and in 1999 its status was listed as stable to declining. It is endemic to central California coastal dunes, including those in Santa Barbara County. The California Department of Fish and Game (DFG 2000) described surf thistle as a short-lived, low-growing perennial in the sunflower family, with whitish flowers in dense heads and large rosettes of spiny, white-woolly, deeply lobed and undulating leaves (Figure 5). Flowering occurs between May and July. It grows in areas of active sand accumulation, such as on the slopes of transverse ridges in the coastal foredunes. Project activities may occur in areas where surf thistle is present on VAFB.

Figure 5. Surf thistle (along with iceplant) found on Vandenberg AFB.

Beach spectacle pod. Beach spectacle pod (Figure 6) is not listed federally but was listed by the State of California as threatened in February of 1990, and in 1999 its status was listed as declining. The plant is currently known to occur in the dunes of San Luis Obispo and Santa Barbara counties and on San Nicholas and San Miguel Islands (DFG 2000). DFG (2000) describes beach spectacle pod as a low growing, whitish-flowered perennial herb in the mustard family that is found in small, transverse foredunes approximately 98 to 164 feet (50 to 300 meters) from the surf. Project activities may occur in areas where beach spectacle pod is present on VAFB.

Figure 6. Beach spectacle pod, as found on Vandenberg AFB.

Beach layia. The only federally endangered/threatened plant species known to occur within the aforementioned vegetation communities on VAFB is the endangered beach layia (*Layia carnosa*)[2]. However, beach layia is not expected to be found at the sites selected for project activity. Beach layia was federally listed as endangered in 1992, and was listed by the State of California as endangered in 1990. USAF (2003) provides the following information on the beach layia. The beach layia is a small annual herb in the family Asteraceae with white ray flowers and unscented yellow disk flowers. It was formerly known to occur along the coast from Humboldt County to near Point Conception and was believed to have been extirpated from Santa Barbara County, and be in danger of extinction elsewhere. However, a small population of about 80 individuals was located on VAFB during the spring of 1995 (USAF 2003). In 1995, it was only known to occur on south VAFB in close proximity to Surf Road; in 1998, the population was reported to have extended westward and along the roadside (Keil and Holland 1998). Additionally, in 1997, a second population of beach layia was found directly west of the first population, at the edge of the bluffs overlooking the beach below[3]. Key threats to beach layia include susceptibility to mowing, herbicide spraying, trampling, and off-road vehicle activity associated with road maintenance, and the invasion of the beach layia habitat by exotic plants, particularly veldt grass (*Ehrharta calycina*) and iceplant (USAF 2003). As beach layia is not expected to be found within the project area, it is not expected to be impacted by project activities.

Threatened, Endangered, and Special Status Wildlife

Several threatened and endangered animals regularly occur on VAFB. A listing of all of VAFB's special status, rare and listed animal species, along with their status and occurrence on VAFB is available in the Final Draft Integrated Natural Resources Management Plan for Vandenberg Air Force Base California (USAF 2003). Federally endangered species include the unarmored three-spine stickleback (*Gasterosteus aculeatus williamsoni*); tidewater goby (*Encyclogobius newberryi*); Southern steelhead (*Oncorhynchus mykiss*); California least tern

[2] Gillespie, C., pers. comm., VAFB Botanist, in USAF 2000.
[3] Gillespie, C., pers. comm., VAFB Botanist, 2003.

(*Sterna antillarum browni*); California brown pelican (*Pelecanus occidentalis californicus*); and southwestern willow flycatcher (*Empidonax traillii extimus*). In addition to the plover, federally threatened species include the southern sea otter (*Enhydra lutris nereis*), and the California red-legged frog (*Rana aurora draytonii*).

Of the federally endangered species, the California brown pelican and the California least tern can occur in plover habitat. In addition, the endangered southern steelhead and tidewater goby are found in the Santa Ynez River, and the tidewater goby and the unarmored threespine stickleback are found in San Antonio Creek (USAF 2003). The American peregrine falcon (*Falco peregrinus anatum*), which can also be found in plover habitat, was delisted from the federal endangered species list in mid-1999, but is still on the state endangered species list. Protected marine mammals such as harbor seals *(Phoca vitulina)* can also occasionally be found in or near plover habitat.

USAF (2003) describes the unarmored threespine stickleback, the tidewater goby, the southern steelhead, the peregrine falcon, and the California brown pelican as summarized below.

- The unarmored threespine stickleback is a federally endangered fish species and a California state endangered species. This stickleback is native to San Antonio Creek and requires slow water flow, low turbidity, and aquatic vegetation for nest material and cover. Changes in water flow, water level and plant growth can cause loss of habitat, and the stickleback is sensitive to excessive sedimentation. Key threats to the unarmored threespine stickleback at VAFB include habitat loss due to lowering water flow in the San Antonio creek, as a result of the draw down of the San Antonio Aquifer, and beaver activity in San Antonio Creek that can result in pooling and encourage the introduction of exotic fish species that prey on the stickleback (USAF 2003). Work associated with this project would not be expected to impact the stickleback, as the closest selected area for project activity is approximately 164 feet (50 meters) from the water.
- The tidewater goby is a federally endangered fish species and a California species of concern, and is found up to 6.2 miles (10 kilometers) inland in brackish waters. In California, VAFB provides the furthest inland extension of tidewater goby habitat. The tidewater goby occurs in the Santa Ynez River and estuary, in the Santa Ynez and San Antonio lagoons, and in all of the major creeks on VAFB including San Antonio, Canada Honda, and Shuman. Key threats to the goby include habitat loss and reduced ground water levels in San Antonio Creek (USAF 2003). Work associated with this project would not occur in or on the banks of either San Antonio Creek or Santa Ynez River, or in other water bodies in the project area and, therefore would not be expected to impact tidewater gobies.
- The Southern steelhead is a federally endangered fish species and a California species of concern. Historically, the Santa Ynez River was a major spawning ground and nursery for steelhead and supported the largest steelhead run in Southern California. The completion of Gibraltar Dam in 1920 and Bradbury Dam in 1953 resulted in a diversion of the water flow from the steelhead's spawning areas. Along with the lack of water releases from Cachuma Reservoir that provided water for migration, spawning, and rearing, the lack of salvage facilities at the dam has been cited as the primary cause for the decline of the run (Titus and Erman 1993). Key threats to steelhead include water diversion and blocked access to historic spawning and rearing habitat due to Gibraltar

and Bradbury dams (USAF 2003). Work associated with this project would not occur in or on the banks of either San Antonio Creek or Santa Ynez River and, therefore would not be expected to impact steelhead.

- The peregrine falcon was delisted as a federal endangered species in August of 1999. It is still on the California endangered species list. Two pairs of nesting peregrine falcons have been known to inhabit the rocky cliffs near South VAFB. VAFB is estimated to have approximately 60 acres of suitable nesting habitat with high, rocky outcrops and ledges of high cliff faces. Key threats to peregrine falcons include harassment/disturbance and habitat degradation (USAF 2003). Work associated with this project would not be expected to cause significant disturbance to peregrine falcons, as the project areas would not be near the known nest sites and most project activity would be conducted outside of their breeding period. Disturbances to peregrines would be expected to be limited to the flushing of roosting or feeding birds from the beach and dunes.
- The California brown pelican is federally listed as an endangered species and is also on the California list of endangered species. On VAFB, the brown pelican roosts on rocky cliffs and coastal bluffs and feeds in offshore waters. Peak numbers occur from June through January as the pelicans migrate north. They have been seen at many locations along the VAFB coastline, including near Point Sal, near the mouths of Shuman Creek, San Antonio Creek, and the Santa Ynez River, as well as at Purisima Point and the Boat House breakwater. Anacapa Island in the Santa Barbara Channel is the nearest known nesting site. Key threats to pelicans include disturbance to rocky cliffs and roosting areas (USAF 2003). Work associated with this project would not be near the documented nesting areas and, therefore, disturbance to this species would be expected to be limited to flushing occasional roosting individuals. Activities near San Antonio Creek are unlikely to affect pelicans, as pelicans not likely to be present at this location from 1 October to 28 February when most project activities are occurring (Collier et al 2002). It is also unlikely that pelicans at Purisima Point will be affected, as the activities would occur over 0.62 miles or 1 kilometer away. Pelicans could be present at the Santa Ynez River mouth during the 1 October to 28 February activities (Collier et al 2002); however, as this is not a main roosting site on VAFB, activities would be expected to be limited to the flushing of occasional roosting individuals.

The California least tern is a federally endangered and California state endangered migratory bird species that nests in coastal dunes and similar habitats from Baja California to the San Francisco Bay. At present, the only breeding colony on VAFB is located near Purisima Point in the coastal foredunes (USAF 2003). Other areas on VAFB are used by least terns for foraging and roosting, including the Santa Ynez River mouth and lagoon, San Antonio Creek mouth and lagoon, and Shuman Creek mouth. USAF (2003) reports that the least tern nesting site and other potential nesting habitat on VAFB are closed to recreational access during the breeding season from 1 March to 30 September. These closures are patrolled, posted, and fenced. This species winters in Latin America and is typically not present on VAFB between September and mid-April. Key threats to least terns include harassment and/or disturbance and predation by other wildlife species (USAF 2003). Plovers have been documented as nesting in the least tern colony on VAFB every year since 1994 (SRS Technologies 2002a). The work associated with this

project would not be expected to impact least terns because the majority of project activities would be accomplished outside of the tern breeding season.

Marine mammals that haul out on VAFB consist mainly of Pacific harbor seals *(Phoca vitulina)*. Up to approximately 500 of these seals haul out at any one time along the VAFB coastline (SRS Technologies 2002b). California sea lions (*Zalophus californianus*) and a minimal number of northern elephant seals (*Mirounga angustirostris*) are also seen on VAFB beaches. These three pinniped species are not threatened or endangered, but are protected under the Marine Mammal Protection Act. Work associated with this project would not be conducted near any of the identified marine mammal haul-outs; therefore, any work associated with this project would not be expected to impact marine mammals.

METHODS

MANAGEMENT APPROACH

This plan incorporates steps recommend in the *Weed Control Methods Handbook* (Tu et al. 2001) for an adaptive management approach to weed control, as outlined below:

1. Establish conservation targets and goals.
2. Identify and prioritize species/infestations that threaten targets and goals.
3. Assess control techniques.
4. Develop and implement weed management plan.
5. Monitor and assess impact of management actions.
6. Review and modify the approach as necessary.

It is expected that coordination/approval of several regulatory agencies would be necessary prior to project initiation. Consultation would be expected to occur with the USFWS, the California Coastal Commission, and the State Historic Preservation Office (SHPO). It would also be expected that an Environmental Assessment at minimum would need to be performed in order to meet National Environmental Policy Act requirements.

SUMMARY OF INFORMATION AVAILABLE FROM PREVIOUS INVASIVE PLANT SPECIES REMOVAL PROJECTS

The *Weed Control Methods Handbook* (Tu et al. 2001) notes, "…more often than not, successful weed control requires the combination or sequential use of several methods." It further states that each method has "advantages and disadvantages in terms of effects against target weeds, impacts to untargeted plant and animals, risks to human health and safety, and costs." It is important to note that two different types of objectives are referenced in this plan - those with a focus on restoring areas for use by plovers and those with a focus on removing an invasive plant species from an area. While these objectives are different, most removal methods are valid toward achieving either.

Previous projects that have documented efforts where invasive plant species have been removed in an attempt to improve plover habitat include: Peterson et al. 2003, Oregon Department of Fish and Game 1996 in USFWS 2001a, USDA Forest Service 1995, and USDA Forest Service undated. Information from these projects, and other projects where European beachgrass or iceplant was removed is presented in this section, along with available cost information, and some pros and cons associated with particular removal methods. Pros and cons of each method are also summarized in a table at the end of this section. In the following section, (*Generalized Treatment Methodology Suggested For Use at Vandenberg Air Force Base*) information is provided on the specific removal methods that are suggested for use for this project at VAFB.

Methods Previously Used for Removal of European Beachgrass

European beachgrass's extensive underground network of rhizomes makes its eradication extremely challenging (Pickart 1997). However, as described in the summarized projects below, the following methods have been used in various projects to successfully eradicate beachgrass.

Manual Removal

Manual removal involves using hand labor to slice through the plants rhizomes below soil level and then removing the plant material to a disposal area (USFWS 1995). A project at Coos Bay North Spit, Oregon using inmate labor found that pitchforks seemed to be the most effective tool used, and suggested that sturdy hand trowels might also be valuable during hand pulling treatments (Oregon Department of Fish and Wildlife 1996).

In a pilot restoration project conducted by Humboldt State University and The Nature Conservancy at a Humboldt Bay site, isolated stands of beachgrass ranging from 0.1 to 0.3 acres (50 to 120 square meters [m^2]) were dug up and removed to a depth of approximately 1 foot (30 centimeters)(Pickart et al. 1990). The stands were first dug in February as the plants were emerging from dormancy. They were then regularly retreated manually through two growing seasons. Complete beachgrass eradication was achieved in 2 years (Pickart et al. 1990).

At Point Reyes National Seashore in 2001, beachgrass was initially removed using trenching shovels and was dug to a depth of 10 to 40 inches. Re-sprouts were later removed by severing them with a long bladed D- handled blade to a depth of 10 inches. In 2002, all 2001 dense removal areas were re-treated at least twice for re-sprouts, which had begun occurring within one month of initial removal. Follow-up treatment was required for at least three years after initial removal and it was noted that a significant amount of resources were spent in Years 2 and 3 on follow-up removal of beachgrass re-sprouts. Dense removal areas were again re-treated at least twice in 2003, when it was noted that re-sprouting continued to occur, but with less vigor. Pretreatment European beachgrass stem counts of an average of 176 stems/m2 in 2001 were reduced to an average of 54 stems/m2 in 2002 after initial removal and an average of 17 stems/m2 in 2003 after follow-up removal.

In 2002, Point Reyes National Seashore experimented with initial manual removal to a depth of 3.3 feet (1 meter), in hopes of reducing costs of removal of re-spouts (Peterson et al. 2003). Peterson later recommended removal to a depth of 1.6 feet (0.5 meters) when removing beachgrass by hand, as they had found little difference in re-sprouting between plots dug to a depth of 0.5 meter vice 1.0 meter (B. Peterson, personal communication).

Beachgrass growth was noted as being stimulated by sand burial, i.e. beachgrass on the windward side of the foredunes grew most actively, while that on the leeward side grew less vigorously (Peterson et al. 2003).

In a study conducted at The Nature Conservancy's Lanphere-Christensen Dunes Preserve in Humboldt Bay, CA, Pickart (1997) estimated that the amount of labor required to dig, pile, and burn beachgrass was 1,858 person-hours per acre. Additional person-hours per acre were required for transport and walking into the site, both of which required a 90-minute round trip. Using the local rate (in the Humboldt Bay, CA area) at that time ($11.75 per hour) and incorporating transportation costs ($12,843 per hour), the removal cost totaled $34,674 per acre.

Costs would be lower for sites that are more accessible and/or less remote. Pickart (1997) also found that the most labor-intensive part of manual control is the first dig, due to the large biomass, stem density, and the difficulty of severing rhizomes. Chestnut (1999), in a report about the Nipomo Dunes in San Luis Obispo County, CA reported European beachgrass removal cost for manual labor to be greater than $34,000 per acre. Peterson reported manual removal costing approximately $14,000/acre when removal was to 1.6 feet or 0.5 meters, and $28,000/acre when removal was to 3.3 feet or 1.0 meter (B. Peterson, personal communication)

One pro of using a manual removal method relates to the fact that European beachgrass can hide small native plants. Manual removal can allow for the removal of beachgrass while retaining natives in place, which in turn can lead to them flourishing and eliminating the need for revegetation. Retention of these natives therefore can lead to decreased effort and cost associated with revegetation (Pickart 1997).

Chemical Treatment

Chemical treatment for the purposes of this document involves the application of a glyphosate at a selected concentration by backpack sprayer or truck mounted hose sprayer application. Different concentrations have been used in previous studies with varying results.

Pickart and Sawyer (1998) reported increased effectiveness with higher concentration rates and with the use of a surfactant. They reported efforts at four trial locations did not reach 75 percent reduction in live cover until a 10 percent concentration was used. However, VAFB has reported success using a 2 percent concentration of Roundup applied during growing season (N. Read, personal communication in USFWS 1995). Oregon Dunes National Recreation Area is reported to have used an 8 percent Rodeo and a nonionic surfactant. Employees there found that follow-up applications within 2 weeks of the first treatment were crucial for obtaining optimum coverage and initial die-off rates of 90 percent (USFWS 1995).

Chemical removal has been found to be most effective during the active growth phase of the plant. Pickart (1997) also reported that the effectiveness of chemical treatment was found to be dependent on consistency and thoroughness during application.

While actual cost estimates for chemical treatment of beachgrass are lacking, Pickart (1997) stated chemical treatment was likely to be "the most cost-effective method of those used to date" for treating beachgrass (versus the manual or mechanical efforts used in their study).

Drawbacks associated with this method included: 1) difficulty with spraying when native plants were present; 2) removal of the large dead biomass; 3) and potential need for manual follow-up (Pickart 1997). Additionally, strict application protocols must be used with chemical treatments. Weather conditions must be considered when spraying; application must occur during no- or low-wind conditions.

Mechanical Removal

Mechanical removal involves the use of bulldozer-type equipment to dig under the beachgrass and its roots, and then removal of the material for disposal. Alternatively, mechanical removal may involve digging under the beachgrass and its roots, burying the beachgrass in a deep hole, and covering the biomass with a layer of "clean" sand, i.e. sand that does not contain fragments of the invasive species being removed.

At the Oregon Dunes National Recreation Area, the U.S. Forest Service used a combination of treatments including the use of heavy equipment to scalp off the top one meter of beachgrass and then burying it in an adjacent trench and covering it with a minimum of one meter of sand. Moderate to heavy resprouting occurred with this method and additional follow up with manual or chemical treatment was required (USFWS 2001a).

Point Reyes National Seashore also used mechanical removal to clear 4 acres of beachgrass at Abbott's Lagoon in 2004. They used two excavators (13 and 21 metric tons) and a four-step process for the removal technique. First, they cleared an area of approximately 13 feet by 16 feet by 3.3 feet (4 meters by 5 meters by 1 meter) deep. They took care to dig deep to removal all the rhizomes and roots. The beachgrass and "dirty sand" was piled on top of adjacent mature beachgrass. In the second step, the clean sand beneath was dug out and stockpiled in an adjacent "clean sand" area. At this point, the pit was approximately 9.8 feet or 3 meters deep. Third, the deep pit was filled with the recently removed beachgrass and all the dirty sand. The pit was filled to within approximately 3.3 to 4.9 feet (1 to 1.5 meters) of the surrounding elevation. Finally, they used the clean stockpiled sand to fill the top 3.3 to 5 feet (1 to 1.5 meter) layer, and the clean sand was smoothed to grade. They noted that the actual burial depths at the project site varied from 1.6 to 4.9 feet (0.5 to 1.5 meters) due to miscommunication with the equipment operator.

Mechanical removal is frequently used in combination with chemical or manual removal methods. Pickart (1997) reported that at Coos Bay Shorelands, the U.S. Bureau of Land Management used a combination of activities to treat 50 acres of European beachgrass adjacent to a snowy plover nesting site (Rittenhouse, pers. comm. in Pickart 1997). The grass had been unsuccessfully treated with salt water in the summer of 1996; several months later in the fall, a D-8 Caterpillar with a wing ripper was used to remove rhizomes to 3 feet below the surface. In March of the following year, a single manual pulling treatment was performed. These treatments were apparently effective, although it was not possible to separate the effects of each treatment (Pickart 1997).

Mechanical clearing costs (not including necessary re-treatment) at the Guadalupe-Nipomo dunes in San Luis Obispo County California were estimated to be more than $15,000 per acre (Chestnut 1999). Peterson noted that mechanical removal cost in their back dunes was $5,400/acre, while it was $8,000/acre in the foredunes (B. Peterson personal communication). Their costs included fuel, equipment rental, and operator salaries, and the equipment traveled 1.5 miles to and from the work site to a refueling point every other day, which added to the cost per acre. The cost variation between the back dune and foredune area was due to the beachgrass plants at the leading edge of the foredunes (the first 98 to 131 feet [30 to 40 meters]) having rhizomes deeper than those in the back dunes. Part of the cost increase for the foredune work was due to more fuel being used to dig deeper and the use of slightly more expensive machinery (B. Peterson personal communication).

Disposal cost may be decreased if the biomass removed is buried, but burial may only be feasible in limited circumstances.

One benefit of mechanical as opposed to chemical removal is that the treatment does not need to be timed to coincide with periods of active growth of beachgrass (i.e. February through June), which overlaps in large part with plover breeding season.

Other Methods Previously Used for Removal of European Beachgrass

Saltwater application to eradicate beachgrass has not proven effective in previous experiments (USFWS 2001a, Pickart and Sawyer 1998) due to the saltwater not being able to penetrate the grass's root area, the raised soluble salt levels not persisting in the soil, and resistance of dormant rhizomes to saltwater inundation. Therefore saltwater application would not be recommended during this project's implementation.

Burning has proven an effective method for eradicating beachgrass when followed by herbicide treatments. While this eliminates the dead aboveground biomass, it does not account for the vast underground root system, which may hold dunes together for extended periods of time. Therefore, this method would not be recommended as a method for beachgrass eradication during this project. However, burning may be a valid method of disposing of large amounts of vegetative matter that result from eradication using other methods previously described.

Methods Previously Used for Removal of Iceplant

Pickart and Sawyer (1998) reported that most documented accounts of iceplant removal do not provide quantitative documentation of results or cost, and instead focus mainly on methods employed. The cost to dispose of dead iceplant material needs to be considered when selecting manual, mechanical, and chemical removal methods. Unless a large area is available for stockpiling, the cost for offsite transportation would also need to be taken into consideration (Pickart and Sawyer 1998). At VAFB, there would be no extra cost for disposal at the VAFB landfill.

Manual Removal

Pickart and Sawyer (1998) reported that hand removal of iceplant has been successful. They provided information on a comparative study (Theiss 1994) of iceplant removal methods in which shovels were used to roll the mats of iceplant, while the roots were severed from below. The resulting area was then raked to remove remaining debris. This resulted in almost complete eradication after one year, although some areas that had been missed required repeated treatment.

Although estimated costs for manual removal of iceplant is lacking, the cost should be less than that for beachgrass removal, because iceplant does not have the extensive underground network of rhizomes.

Hand pulling is complicated by the bulk and weight of the pulled material. Additionally the capability of the plant to reroot or resprout from fragments makes it necessary to remove all plant material and properly dispose of it without leaving fragments (SAIC 2001).

Chemical Treatment

Bossard (2000) reported that application of glyphosate was effective in controlling iceplant when used at a concentration of 2 percent or higher and that use of a surfactant (Moss, pers. comm. in Bossard 2000) and acidic water may increase mortality rates. The report also noted that 1) it may take several weeks for the iceplant to die and 2) resprouting is possible.

Pickart and Sawyer (1998) reported that one project at Spanish Bay on the Monterey Peninsula applied herbicide in the spring, when wind velocities were less than 8 kilometers per hour and when no rain was predicted. This resulted in iceplant eradication. Dye was used to ensure even distribution of the chemical. Bossard (2000) also noted (via Moss pers. comm. 1998) that treating iceplant in early- or mid-winter could decrease impacts to native species, as they were mostly dormant during that period.

SAIC performed experiments in dune scrub habitat on VAFB and found the best overall results were obtained when iceplant was sprayed and left in place (Earth Tech et al. 1996). Pickart and Sawyer (1998) noted that leaving dead iceplant mats in place may not be appropriate in areas where elevated nutrient levels and exotic invasions may be problematic. However, soil nutrients should be very low in the foredunes on VAFB[4] where the majority of project activity would occur.

The California Department of Parks and Recreation (1992) estimated the cost of chemical treatment of iceplant varied at five of their sites from $740 to $1,306 per acre depending on site accessibility and plant density (Pickart and Sawyer 1998).

Drawbacks associated with using chemical treatment for removal of iceplant are similar to those listed above for beachgrass removal.

Mechanical Removal

[4] Gillespie, C., pers. comm., VAFB Botanist, 2003.

Mechanical removal of iceplant using heavy machinery can be effective; however it can result in significant disturbance to and removal of soil (SAIC 2001). Theiss (1994) reported that The Nature Conservancy used a bobcat with a bush-rake attached to the bucket to remove iceplant. They had the most success using the curved surface of the tines on the upper-side of the rake. A temporary stockpiling of the material was found to be problematic, as additional sand was incorporated during this period (Pickart and Sawyer 1998). As with hand pulling, care must be taken to remove and properly dispose of all plant fragments.

Other Methods Previously Used for Removal of Iceplant

Burning has not been found to be effective in eradicating iceplant due to the high moisture content of the species (Bossard 2000); therefore this method would not be recommended for this project's implementation.

Solarization has been used successfully on iceplant under certain conditions (Bossard 2000). However, it is reliant on solar energy and is likely most effective in the spring and summer months, which coincide with the plover breeding season. Conditions at VAFB are often windy, cold, and often overcast. Consequently, while this method has been used successfully in some areas, it is believed that the climatic conditions at VAFB, and the relatively secluded locations where it would be used, and the size of the area to be treated would make application and maintenance difficult. These conditions are not conducive to the effectiveness of this technique, therefore, solarization would not be recommended for this project.

The following table provides some of the pros and cons, as generalized below, associated with each of the *recommended* removal methods, as described in the following section. Pros and cons are relevant for both beachgrass and iceplant treatments.

Table 1. Pros and Cons of Recommended Removal Methods.

Method	Pros	Cons
Manual	• Can retain native plants in treatment area • Native plant retention may reduce revegetation costs	• Expensive/labor intensive • Difficult to remove large amounts of biomass if necessary
Chemical	• Relatively cost-effective • Minimal amount of physical disturbance to selected area	• Potential damage to neighboring native plants • Application more effective if timed with growing season • Difficult to remove large amounts of biomass if necessary • Retreatment likely necessary • Weather restrictions (wind and precipitation)
Mechanical	• Treatment can be independent of growing season • Ability to change topography	• Chemical or manual follow-up treatment likely necessary • Significant disturbance to treatment area, although may be intentional at selected location

GENERALIZED TREATMENT METHODOLOGY SUGGESTED FOR USE AT VANDENBERG AIR FORCE BASE

The following generalized treatment methodologies are suggested for use at VAFB, pending site-specific characteristics. **The majority of this project's activities that would occur within designated critical habitat would be accomplished between 1 October and 28 February in order to avoid disturbance to plovers during the breeding season.** Efforts would be made to minimize adverse impacts to isolated or unique individuals or populations of animals or plants, special status plant and animal communities, and habitat for special status animals. In addition, efforts would be made to minimize adverse impacts to archaeological sites, if any are present in the selected treatment area.

Manual Removal

Manual removal would be recommended for use in small areas (less than 200 m^2 or 0.05 acres) of beachgrass or iceplant where there is no need to mechanically alter dune structure, and where native plant species comprise equal to or greater than 40 percent of the total vegetative cover. In areas with high numbers of native plants, using manual treatments would lessen impacts to native species because incidental overspraying with the herbicide would not occur.

Invasive plants would be removed with their roots. Beachgrass would be dug to a depth of 1.6 feet (0.5 meters), while iceplant would be dug to just below the surface to approximately 0.6 feet (0.2 meters). Equipment used for manual removal could include trenching shovels, hand trowels, pitchforks, long bladed D-handled blades, or other items. In areas where iceplant would

be removed, raking would also be recommended in order to ensure any remaining iceplant fragments were removed. Site-specific requirements would determine whether additional alteration to dune structure, using hand tools such as shovels and rakes, would be included with this treatment. Manual treatment would be used for both initial and follow-up treatments. Archaeological and Native American monitoring would likely be necessary where manual treatment is selected as the removal method. Surveying and archaeological testing may also be necessary.

Chemical Treatment

The use of chemical treatment only on large areas would not address the issue of the topography preferred by nesting plover. For beachgrass, if the root system is left in place, it may hold the dunes in an unnatural position, i.e. tall dunes parallel to the coastline, for years. As such, the root system could prevent the area from attaining the characteristics of preferred nesting habitat. Therefore, initial treatment with chemical application would only be recommended for use in areas of beachgrass or iceplant, independent of size, where there is *no need to alter dune structure*.

Additionally, chemical treatment would only be recommended in areas where native plants comprise less than 40 percent of total vegetative cover. If during pre-treatment flora surveys (as described in a later section), special status plant species are found to occur in the area to be treated, they would be flagged immediately prior to treatment activity in order to minimize disturbance to them.

For this treatment method, invasive plants would be treated with the application of an herbicide by backpack sprayer or truck mounted hose sprayer. The dead plant material would be left in place. The proposed chemical to be used in this project is a glyphosate, Roundup PRO Concentrate. Manufacturer's recommendations would be followed, including their recommended concentrations of a 4% hand-held solution for beachgrass and a 1.2 to 1.6% hand-held solution for iceplant. Retreatment or follow-up treatments may be necessary. See Appendix 1 for further label information on Roundup PRO Concentrate.

Strict application protocols must be used with chemical treatments. Weather conditions would be considered when spraying; application would occur only during no- or low-wind conditions. The application would also be timed to: 1) coincide with active growth for beachgrass if possible and 2) avoid the plover breeding season. Based on increasing amount of daylight and available moisture, active growth of beachgrass is expected to occur between February and June. Iceplant's active growth is expected to occur year-round. Therefore, in order to meet the timing described above, chemical treatment could be applied in February for treatment of beachgrass, and anytime outside of plover season for iceplant. The Roundup PRO Concentrate label recommends using the higher application rate within the recommended range if treatment is to occur outside of "growth stages".

Chemical treatment could also be used for follow-up treatment in large areas initially treated mechanically. Follow-up treatments methods would be based on site-specific requirements. Surveying and archaeological testing may also be necessary in areas where chemical treatment is used.

Mechanical Removal

Mechanical treatment would be recommended for use in medium (between 0.05 to 0.25 acres [200 m^2 and 1000 m^2]) to large areas (greater than 0.25 acres or 1000 m^2) of beachgrass or iceplant where substantial alteration of the dune structure is necessary to restore an area to posses the characteristics of plover nesting areas. Mechanical treatment would involve the use of heavy equipment to excavate the invasive vegetation and sand buildup that is not characteristic of plover breeding habitat. Invasive plants would be removed with their roots. Beachgrass would be dug to a depth between 3.3 to 4.9 feet (1 to 1.5 meters), while iceplant would be dug to just below the surface to approximately 0.6 feet (0.2 meters).

After excavation, the excavated vegetative biomass and sand would be sifted in order to separate the biomass and sand. Screening would be done at a limited number of locations adjacent to or within the areas being treated and within the project's disturbance zone in order to limit possibility of spreading vegetative materials. After screening, the vegetative biomass would be trucked to the greenwaste center on VAFB and the sand would be disposed of. These processes are further described below in the section entitled, *Suggested Disposal Methodology for Excess Sand and Vegetative Biomass*.

It is projected that mechanical treatment would be used only as an initial treatment method. Archaeological and Native American monitoring would likely be necessary where mechanical treatment is selected as the removal method. Surveying and archaeological testing and consultation with the SHPO may also be necessary.

Combined

A combination of the above individual treatments would be recommended for use when, based on site-specific characteristics, it is determined to be the most effective treatment. For instance, manual treatment might be used for a small area containing special status plants within a larger area that is being treated chemically.

A combination of treatments may also be used by performing initial treatment with one method and then performing a follow-up treatment at a later date, with a second method. For instance, an area may originally be treated mechanically, and then regrowth treated chemically the following year.

SUGGESTED PRE-RESTORATION SURVEYS AND ACTIVITIES

Flora

Vegetation surveys would be completed in all areas selected for restoration prior to invasive plant removal activities in order to document native plant communities and the presence of special status plants that would or might be impacted. Initial surveys would be conducted outside the plover breeding season, and would note any areas that may require follow-up surveys during the breeding season. In areas where special status plants occur inside the site proposed for manual or chemical treatment, plants would be flagged immediately prior to work efforts in order to minimize disturbance to them. Hand pulling around special status plants where chemical treatment is selected, might be used to address concerns associated with overspray.

It would be assumed that all plants in areas selected for restoration using heavy equipment would be lost. Seeds from special status plants within these areas would be collected prior to initiating dune restoration activities. Seeds might need to be collected during plover breeding if this is when seeds production occurs. When possible, seeds would be collected from individual plants of the same species that are on VAFB, but are not in areas being used by the plover. If seeds were only available in areas being used by plovers during the breeding season, appropriately permitted and trained personnel would be used to minimize disturbance. Collected seeds would be delivered to a growing facility for propagation.

Fauna

Pre-restoration surveys would also be conducted to document terrestrial wildlife species that inhabit the area and to verify the presence of any special status wildlife species. These wildlife surveys would be initiated in specific areas immediately prior to work beginning in that area. Appropriately permitted biological monitors would be used to determine if any special status wildlife species are located within the project areas, and measures such as relocation of the species, avoidance if possible, and halting of activity until the species leaves the area, would be taken to minimize adverse impacts from restoration activities.

SUGGESTED DISPOSAL METHODOLOGY FOR EXCESS SAND AND VEGETATIVE BIOMASS

Aside from excavation, disposal of the excavated sand and vegetative biomass would be expected to be the largest task associated to this project. Some of the available options for disposal of these materials are discussed below. One or more methods may be used to accomplish this task.

Vegetative Biomass

During manual removal efforts, sand can be shaken out of the vegetative biomass, while taking care to not allow plant fragments to be spread. The vegetative biomass could then be removed from the immediate site by pack, all terrain vehicle (ATV), or ATV trailer and then transporting it to the VAFB landfill for disposal as “greenwaste”.

During chemical treatment efforts, the vegetative biomass and sand would be left in place. Therefore no vegetative biomass or sand disposal efforts would be associated with this treatment.

During mechanical removal efforts, the preferred method of beachgrass and iceplant disposal is “screening” the large amounts of vegetative biomass to remove excess sand, and then transporting it to the VAFB landfill for disposal as “greenwaste”. While this is a time intensive process, it has been used successfully to screen other grasses (J. Welch of A.J. Diani, personal communication).

Screening would be performed to reduce and/or remove the sand mixed in with the vegetation being disposed of. Screening would involve screening of the above ground biomass, and screening of the underground root systems. Screening of the excavated material would involve running it over a metal grating allowing the sand to fall through to the ground while the vegetative biomass is caught. One way to accomplish screening would be to construct an 8 foot by 10 foot metal grate with ¾-inch wide gaps. The excavator, used to dig up the vegetation and

the entrapped sand, would then deposit it on the grating. The excavator then picks up the separated vegetation for deposition into a vehicle (or temporary stockpile) for transport to the VAFB. Screening would occur at a limited number of selected locations in order prevent scattering of viable plant materials on the beach. The locations for screening would be directly adjacent to the excavation activities within the disturbance zone as to limit the possibility of spreading vegetative materials.

If disposal at the VAFB landfill was selected as the disposal method for the large volume of beachgrass and iceplant associated with this project, a Letter of Authorization from the government agency managing this project would be necessary stating that the waste would be managed in accordance with the VAFB Waste Management Plan.

Burning is another possible method for disposing of the large amount of beachgrass removed during mechanical treatment. This would significantly reduce the amount of material for disposal. Burning would be accomplished by screening the biomass to remove excess sand, stockpiling it for drying, and then burning it. This method would require the acquisition of burn permits and the development of a burn plan. It would also introduce issues concerning the stockpiles, their potential use by wildlife, and their potential to accumulate blowing sand. Therefore, burning would not be recommended for disposal of beachgrass.

Due to the moisture content of iceplant, drying and burning would not be recommended as a disposal method for this species.

Sand

Due to the extent of sand accretion by some areas of beachgrass, there would be a large amount of sand that would need to be removed from the restoration area. The preferred method of disposal for excavated and screened sand would be to deposit the sand regularly along the beach below the mean high tide line during low tide periods, and then allow it to wash out into the ocean with the ensuing high tide. Salt water may render seeds and vegetation fragments remaining in the screened sand unviable. While this method requires the use of additional heavy equipment and various regulatory permits, it is preferred because the sand would be returned to the natural system instead of removed from the system. Holland and Keil (1995) state that humans have caused changes to shoreline profiles that have changed patterns of sand deposition and erosion. Certain activities such as damming and channeling streams reduce the amount of sand reaching the oceans. Holland and Keil (1995) further note that beaches erode more quickly when annual sand replenishment is lacking and new sand deposits cannot replace the lost sand from the beach. While this project does not propose to dam or channel streams, removing large amounts of sands from the beaches can theoretically have a similar effect on the rate of erosion and replenishment.

Other methods considered but not selected for disposal of excess sand include: 1) Truck the excess sand off site and then used as fill material either on or off VAFB; 2) Use the excavated sand to bury beachgrass to a depth of 3.3 feet or 1 meter in areas not selected for restoration by this project and outside of potential plover habitat, but where it could pose a threat as a potential source for future infestations. Some resprouting would be expected after burial in these areas, and burial could be followed-up with manual or chemical treatment in these areas if desired.

SUGGESTED METHODS FOR RESTRUCTURE AND REVEGETATION OF DUNE HABITAT

In their designation of critical habitat for the Pacific Coast population of the western snowy plover, the USFWS (1999) lists the primary constituent elements essential to the plover as being found in areas that support or have the potential to support: "intertidal beaches (between mean low water and mean high tide), associated dune systems, and river estuaries." They continue by stating that the important components of the beach, dune, and estuarine ecosystem include: "surf-cast kelp, sparsely vegetated foredunes (beach area immediately in front of a sand dune), interdunal flats (flat land between dunes), spits, washover areas, blowouts (a hole or cut in a dune caused by storm action), intertidal flats (flat land between low and high tides)…"

This project will focus on above constituent elements, excepting surf-cast kelp, and will focus on promoting the development of these sparsely vegetated foredunes, interdunal flats, and blowouts.

Restructure of Dunes

Restructuring of dunes would only be employed if it was believed that after invasive plant removal, the remaining dune structure would not be re-contoured by natural processes (such as wind) to result in dune structures possessing the desired nesting characteristics. As it is known that nests typically occur in flat open areas, restructuring of dunes would likely be necessary if, after the removal of exotic vegetation, the remaining dune is 2 feet or higher than the adjacent interdunal flats. Excavated sand would be moved from the foredune area to the intertidal beaches, as described above in the disposal methodology.

Several different pieces of heavy equipment could be used to move sand from the foredune area to the intertidal beaches, depending on site-specific requirements and the method determined to be most efficient. Three common pieces of equipment used for moving large amounts of material include the bulldozer, the excavator, and the scraper.

Scrapers are wheeled vehicles designed to scrape soil from one location while in motion, store it onboard, and deposit it evenly at another location.

Excavators are either tracked or wheeled equipment designed to dig with a bucket attached to a highly maneuverable boom. This piece of equipment is generally not used to transport material further than the reach of the boom, and is most commonly used to load other vehicles, or stockpile the material being excavated within reach.

Bulldozers are commonly used to move large amounts of material over short distances. A project at the New River Spit, OR by the Coos Bay District BLM successfully used a CAT D-7 for a similar plover habitat restoration project. Their project differed from this project in that they did not make efforts to separate exotic vegetation (beachgrass) from the sand; both sand and vegetation were pushed out into the surf zone. For the New River Spit project, removing vegetative cover from a large area had priority over bringing a small area down to grade, and therefore dunes were excavated in stages with mechanical follow-up treatments occurring every year.

It is believed that the use of one or more types of heavy equipment described above would best accomplish the goals of this project. While it appears that a large dozer with a wide blade would be sufficient for most of the sand movement identified by this project, the most appropriate pieces of equipment would be determined by the contractor on a site-specific basis.

Revegetation

Revegetation with native plants can yield positive effects such as decreased erosion and a reduced probability of non-native species invasion in areas that have been cleared of vegetation (Pickart and Sawyer 1998). Revegetation efforts for this project would consist mainly of activities to replace rare or special status species that would be removed or damaged by project activities. Revegetation might also be recommended for areas where it is determined that the sand would need to be stabilized near these rare or special status plant populations.

In areas selected for dune alteration using heavy equipment, it would be assumed that all rare or special status plants in these areas would be lost. Chestnut (1999) reports that use of non-local stock that display distinctly different phenotypes in past revegetation efforts has been a significant problem. Therefore, seeds from the rare or special status plants in the selected restoration areas would be collected prior to restoration activities. These seeds would be taken to a growing facility for propagation. Following dune modification, the area would be revegetated with containerized plants grown from these seeds. Seeds would be collected in summer months, propagated in a green house for approximately a year and then planted the following winter with the first rains.

Revegetation in previous restoration projects has also proven successful without any intentional revegetation efforts. In a pilot restoration project conducted by Humboldt State University and The Nature Conservancy at a Humboldt Bay site, isolated stands of beachgrass were dug and removed (Pickart et al. 1990). The sites were later retreated on a regular basis through two growing seasons; complete beachgrass eradication was achieved in two years. Pickart et al. (1990) noted that although no native plants were intentionally introduced, relict plants present in the initial plot were retained and native cover increased from 2.7 percent to 38 percent one year after treatment.

Peterson et al. 2003 found that overall cover of native vegetation in plots remained low as compared to native dune habitat that has not been infested with beachgrass, increasing from 1.2% in 2001, to 2.3% in 2002 and 2.2% in 2003. However, although there was little change in the vegetative cover, the diversity of native species found within the plots increased from 9 species in 2001 to 14 species in 2002 and 12 species in 2003.

It would be expected for this project that some revegetation would occur naturally in areas where invasive plants had been removed and native species were retained, even where intentional revegetation efforts did not occur.

In addition to revegetation, straw may be used in areas where it is deemed necessary to immediately stabilize sand. Pickart and Sawyer (1998) report that in Monterey CA, Marina State Beach used hand planted bundles of straw to protect an area of existing rare plants from erosion (Ferreia and Smith 1987). Handfuls of straw were buried 3.15 to 3.94 inches (8 to 10 centimeters); 5.9 to 9.8 inches (15 to 25 centimeters) were left exposed. These straw bundles were installed 0.98 to 1.97 feet (0.3 to 0.6 meters) apart in order to deflect wind while still allowing for plant growth.

The following species, which comprise the majority of the small number of species found to occur naturally within plover habitat and that have been found on VAFB (Keil and Holland 1998), are recommended for use in active (i.e. intentional) revegetation efforts:

- Beach sand verbena (*Abronia maritima*),

- Beach-bur (*Ambrosia chamissonis*),
- Beach evening primrose (*Camissonia cheiranthifolia*),
- California saltbush (*Atriplex californica*),
- Beach saltbush (*Atriplex leucophylla*), and
- Dunedelion (*Malacothrix incana*).

Additional species could also be used during revegetation, including VAFB's previously discussed rare or special status species, if these species were found to be present in selected areas prior to restoration activities.

SUGGESTED FOLLOW UP TREATMENT METHODS

Follow-up treatment in all treated areas is absolutely essential to a project's success, and initial removal should not exceed the capacity for re-treatment (Peterson et al. 2003). The follow-up treatment method selected would be dictated by monitoring results. However, it is projected that follow-up treatments would only consist of manual or chemical treatments. Mechanical removal would only be used for large-scale exotic removal and dune restructuring; these activities would only be performed during initial treatments.

Beachgrass re-sprouts should be treated as soon as possible, as they often seem to re-sprout from rhizomes and, early on, do not have well developed root systems (Peterson et al. 2003). Efforts at Siuslaw National Forest also recommended that hand pulling of beachgrass re-sprouts was easier if accomplished within 6 month to one year of initial treatment, before roots had grown deep (C. Burns, personal communication)

In areas where manual methods would be used for re-treatment of beachgrass or iceplant, efforts would take place between October through February annually in order to not interfere with the plover breeding season. Where chemical treatment is selected as the re-treatment method for beachgrass, chemical application would be performed in annually in February in order to coincide with its period of active growth and avoid the plover breeding season. Chemical re-treatment for iceplant would take place between October through February, as it grows year-round at VAFB.

SUGGESTED FOLLOW-UP MONITORING

Follow-up monitoring would focus on two factors. The first would be to determine if there is a reoccurrence of invasive species at the site, if there has been an infestation by an invasive species not previously seen at the site, and to note any colonization by native dune plants. The second focus would be to determine whether plovers used the restored areas during the breeding season for nesting or chick rearing activities. Monitoring results could be used to determine the effectiveness of removal techniques and provide insight into possible improvements. They could also be used to identify correlations between vegetative cover/diversity and usage by western snowy plovers.

Follow-up vegetative monitoring would be comprised of three different methods. These methods would include monitoring of entire treatment areas via annual walkthrough surveys, monitoring of transects, and monitoring of permanent monitoring plots.

Vegetative monitoring for resprouts would be important in that it would provide information on the effectiveness of treatment methods which could be used to make a determination on whether or not treatment methods need modification. Monitoring via a walkthrough of all treated areas would begin after initial treatments at the site were completed. This monitoring would be conducted in order to determine if there was a reoccurrence of invasive species at the site or if there has been an infestation by an invasive species not previously seen at the site. This monitoring, as well as the other vegetative monitoring described below, would be conducted annually and shortly after the end of breeding season each year, which would allow sufficient time for necessary follow-up treatments to occur prior to the beginning of plover breeding activities.

Second, follow-up monitoring would include sampling of permanently established transects on an annual basis. Measurement would be taken on vegetative cover and species diversity. Photographic monitoring would also be conducted during sampling transects, in order to document overall vegetative cover and topography changes. Photographic monitoring would consist of using ground level photos with consistent reference markers.

Third, follow-up monitoring would include establishing two permanent monitoring plots per invasive species removed, within each treated area. For example, if only beachgrass was removed from Area A, then there would be two monitoring plots in that restoration area. If both iceplant and beachgrass were removed from Area A then there would be four plots located within that restoration area. The location of the plots would be selected in order to encompass representative samples of treated areas. In addition, there would be two control plots established in untreated uninfested areas near project activity areas. Plot sites would consist of a 6.5-foot (2-meter) tall corner plot stake placed at the southwest corner of each plot, with GPS coordinates recorded. Each plot would measure 32.8 by 32.8 feet (10 by 10 meters) and contain 12 subplots that were each 3.3 by 6.6 feet (1-meter by 2-meters). Vegetative cover and European beachgrass stem counts would be recorded annually to determine trends in beachgrass cover and native plant cover after removal.

Follow-up plover monitoring would be done in order to identify the effect of restoration efforts relative to the use of the area by plovers for nesting and chick rearing activities. Data from breeding season surveys would be broken down into restoration areas, which would allow for a determination of whether the number of nests in the areas increased or decreased relative to nest numbers in adjacent areas that have not undergone restoration. Brooding activity in areas where dense vegetation would have previously precluded use by plovers would also be noted. Additionally, use of selected areas prior to and after restoration, would be examined.

It is expected that a minimum of 5 years of monitoring after active restoration activities are completed would be necessary before any conclusive determinations could be made regarding the success of the restoration activities with respect to plover breeding use.

AREAS RECOMMENDED FOR INVASIVE PLANT REMOVAL AND SITE SPECIFIC DETAILS

CRITERIA USED TO SELECT AREAS FOR PLAN IMPLEMENTATION

This project targets European beachgrass and iceplant for removal from selected areas on VAFB. The following criteria were used to select areas for invasive species removal and plover habitat restoration. Selections were made with a focus on areas with the greatest potential for creating/increasing or maintaining available nesting habitat, although other factors such as equipment access were also considered by necessity.

- **CRITERIA 1 - Areas with substantial nesting numbers (as compared to other areas on VAFB) for which further degradation from invasive species currently within the area are imminent.** The USFWS (2002) recommends considering historic use by plovers when establishing selection criteria. The Nature Conservancy's Site Weed Management Plan Template (TNC 2001) recommends "assign[ing] highest priority to existing infestations that are the fastest growing, most disruptive, and affect the most highly valued areas of the site."

- **CRITERIA 2 - Areas containing invasive species that when restored would create large areas free of invasive species, or join existing relatively undisturbed dune communities to create a large continuous "belt" of potential nesting habitat.** These types of restored areas would be expected to have the highest potential to persist, i.e. long-term viability, and require the least amount of maintenance to exclude the targeted invasive species. Laye and Mangione (USFWS 1995) note that many of the sites that they mapped, while small, had an abundance of "source material" immediately adjacent to them. Source areas were defined as "patches of European beachgrass greater than ten by ten meters square and greater than three meters from snowy plover nesting habitat" which, served as a continual source of beachgrass seed or propagules, and posed a constant threat. Therefore many of Laye and Mangione's small mapped sites, if removed, would only be expected to have minimal long-term success for controlling with small-scale efforts. This criteria is also supported by Wiedemann and Pickart (1996), who recommend giving priority to projects that are likely to be viable in the long-term because they are "large in size or are adjacent to existing, relatively undisturbed dune communities." In efforts in the second year at Point Reyes National Seashore, one of their two areas focused on an area whose removal would create a 78-acre treated area. The USFWS (2002) also supports long-term viability.

- **CRITERIA 3 - Areas in proximity to an area of relatively high plover nesting activity where removal of the isolated patches of invasive species would prevent its future spread.** Wiedemann and Pickart (1996) suggest prioritizing control of incipient, 'satellite' populations that threaten existing natural communities (Moody and Mack 1988). Peterson et al. 2003 focused their initial efforts on "small, rapidly expanding patches of European beachgrass adjacent to high quality native dune vegetation. In addition, new satellite populations (which have the potential for the most rapid expansion) were removed from the beachfront and from stands of native vegetation

throughout the project area." The Nature Conservancy's Site Weed Management Plan Template (TNC 2001) recommends acting "to prevent new infestation…"

- **CRITERIA 4 - Areas that would incur minimal disturbance by humans during the breeding season.** The USFWS (2002) recommends considering proximity and concentration of human activities when establishing selection criteria. Human disturbance has the potential to negatively affect breeding success at all stages.

- **CRITERIA 5 – Areas where impacts to cultural resources would be minimal/avoidable.** VAFB has over 2200 known archaeological sites (VAFB General Plan 2000). Archeological resources include items such as bone and stone tool remains, hunting and gathering stations, and ceremonial rock art. Native American resources include burial and other spiritual sites, as well as archaeological sites such as those associated with historical villages (VAFB General Plan 2000). Removal efforts in some areas may require surveys, archaeological testing, and/or consultation with SHPO. Archeological and Native American monitoring would be used to minimize/avoid impacts to cultural resources.

- **CRITERIA 6 - Areas where there is reasonable access available to reach the invasive species with the equipment necessary for the chosen removal technique.** The Nature Conservancy's Site Weed Management Plan Template (TNC 2001) recommends considering the difficulty of control and prioritizing infestations that are most likely to be controlled with available technology and resources.

The table below (Table 2) shows which of the above-described criteria are applicable to the selected areas. Selected areas are further described immediately following the table.

Table 2. Areas recommended for invasive plant removal and relevant selection criteria.

	Recommended Areas			
Selection Criteria	**Area A** South of San Antonio Creek Mouth	**Area B** South End of San Antonio Beach	**Area C** San Antonio Beach between Areas A and B	**Area D** Surf Beach North
Criteria 1 – Areas with substantial nesting numbers (as compared to other areas on VAFB) for which further degradation from invasive species currently within the area are imminent.			X	
Criteria 2 – Areas containing invasive species that when restored would create large areas free of invasive species, or join existing relatively undisturbed dune communities to create a large continuous "belt" of potential nesting habitat.		X		X
Criteria 3 – Areas in proximity to an area of relatively high plover nesting activity where removal of the isolated patches of invasive species would prevent its future spread.	X			
Criteria 4 – Areas that would incur minimal disturbance by humans during the breeding season.	X	X	X	
Criteria 5 – Areas where impacts to cultural resources would be minimal/avoidable.	X	X*	X	X
Criteria 6 – Areas where there is reasonable access available to reach the invasive species with the equipment necessary for the chosen removal technique.	X	X	X	X

* = See discussion of necessary efforts in following section describing Area B.

AREAS RECOMMENDED FOR INVASIVE PLANT REMOVAL

Beachgrass and iceplant, are present, either separately or together, along the majority of the VAFB coastline where plovers nest. Based on the selection criteria, four areas are recommended for restoration efforts and are described below. Approximately 62 acres of beachgrass would be targeted for removal, and approximately 2 to 3 acres of iceplant would be targeted. The following information is provided for each area:

- Location and size of area
- Targeted invasive species that are present in the area
- Pre-infestation composition
- Past nesting activity in the selected area*
- Specific selection criteria relevant to selected area
- If area was previously recommended for removal of invasive plants
- Treatment methodology recommended for removal of invasive plants
- Method recommended to access the site and potential fueling/maintenance locations
- Method recommended for vegetation and sand disposal if necessary
- Recommendation for whether or not dunes should be recontoured
- Recommendation for whether revegetation is necessary

* = Monitoring of plovers on VAFB began mid-season in 1993. In 1994 through 2000, monitors used the best of their ability to plot nest locations on a map; these locations were then converted to Geographical Information System (GIS) coverages. In 2001 through 2004, GPS coordinates of all nests were taken. Nest numbers were generated from the GIS coverages and were calculated using the north/south boundaries perpendicular to the ocean and including all nests within the nesting habitat that fall within those boundaries. The data for the year 2000 is unavailable to VAFB.

Area A – South of San Antonio Creek Mouth

Area A is located immediately south of the San Antonio Creek mouth and is comprised of European beachgrass dunes (approximately 1 acre in area) and the several hummocks infested with iceplant that are immediately adjacent to these dunes (less than 1 acre) (Figure 7 and Figure 8). Beachgrass dunes in the area are located in the northwest corner of a mostly flat area strewn with debris that extends southward along the coast for approximately 0.56 miles (0.9 kilometers). These dunes were previously described as hummocks (USFWS 1995), i.e. a low mound or ridge of earth, but are now greater than 10 feet high. Inspection of aerial photographs dated 20 February 1954 reveal there were no densely vegetated dunes in this area at that time.

Nest numbers within the north/south boundaries of Area A (from 1994 to 2004, excluding 2000) have ranged from 0 nests in 1999, 2001 and 2004 to 8 nests in 1997 (Persons 1995a, 1995b; Persons and Applegate 1996, 1997; Applegate and Schultz 1999, 2000, 2001; PRBO 2001; SRS Technologies 2002a, 2003, 2004).

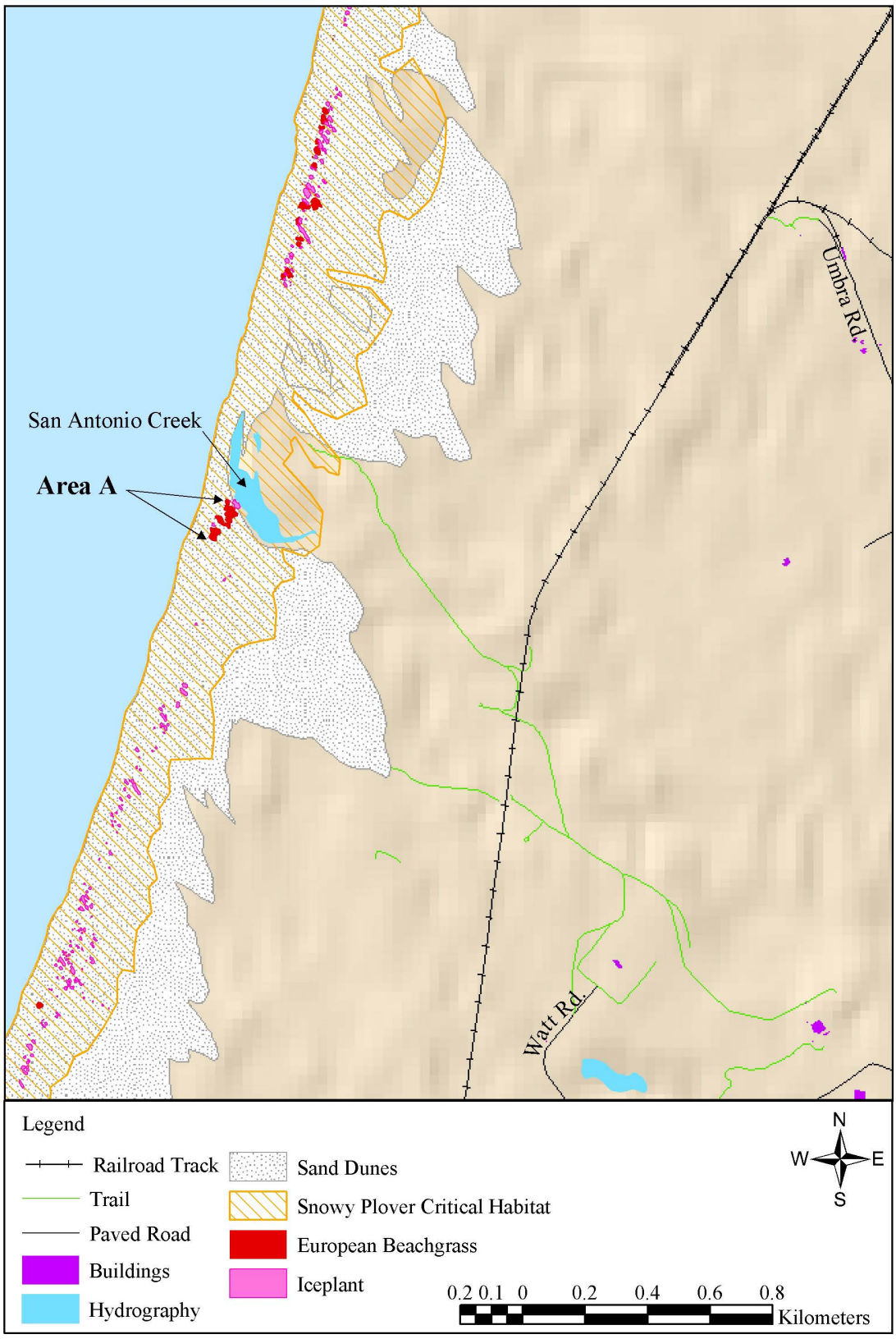

Figure 7. Area A, recommended for European beachgrass and iceplant removal.

Figure 8. Area A, comprised of European beachgrass dunes and several adjacent hummocks infested with iceplant.

These dunes and nearby solitary patches of beachgrass are targeted for removal due to their proximity to an area of relatively high plover nesting activity (Criteria 3). While the amount of habitat that would be created is minimal, the removal of the isolated patch of beachgrass would prevent its future spread. As previously discussed, several authorities concur that isolated patches of beachgrass should be removed before they spread and then consequently, require a more significant effort to remove them. This area also qualifies as an area that incurs minimal human disturbance and the area is closed to recreation during the breeding season (Criteria 4). Archeological and Native American monitoring should be sufficient measures to ensure potential impacts to cultural resources are minimized/avoided (Criteria 5) if manual removal is used, although a site survey and limited testing may be needed to determine site boundaries. Additionally, there is reasonable equipment access to the area via trail access as described below (Criteria 6).

In 1995, Laye and Mangione (USFWS 1995) noted this area as an "interesting occurrence" of beachgrass in the area south of the San Antonio river mouth. They described the site to "exhibit the hummock form of European beachgrass colonization" and stated that the area was approximately 0.04 acres (150 square meters) and contained 15 hummocks. They went on to include this area in their Recommended Eradication Sites (USFWS 1995). The site noted by Laye and Mangione corresponds to Area A and was described as follows:

> South of the mouth of San Antonio Creek is a section of western snowy plover habitat occupied by a series of European beach grass hummocks. [Note: As stated above, these now qualify as full dunes at greater than 10 feet tall.] This area of beach is also one of the most heavily used areas by western snowy plovers in the San Antonio Beach sector. The removal of these hummocks would result in more

available habitat and would eliminate a source for future European beach grass invasions.

The recommended method of invasive species removal for Area A is manual removal by shoveling and hand pulling. Access to this site would be on foot or ATV via an existing footpath that connects the San Antonio creek mouth with the northernmost part of railway access road. This access road connects Tangier Road with the San Antonio Creek railroad trestle. The trailhead is immediately west of the trestle on the south side of the creek (Figure 9). A potential fueling/maintenance area is located west of this access route, off of Road 3, approximately 1.7 kilometers from the Area A (Figure 9).

The vegetation that is removed would be shaken/sifted to remove excess sand at the site, then removed from the immediate site would either be by pack, ATV, or ATV trailer. Ultimately, the sifted vegetation would be trucked to the VAFB landfill. No restructuring of the dunes in Area A is recommended and, therefore there would be no need to dispose of excavated sand. While the largest dune in this group is significantly larger than any native vegetated dune in this area, leaving this mass of sand in place would not degrade the adjacent plover habitat. With time, it would be expected that the dunes would decrease in size due to wind erosion and become revegetated with native plants from the seed of nearby plants, and those left in place during the manual removal. Therefore, no revegetation would be recommended for this area.

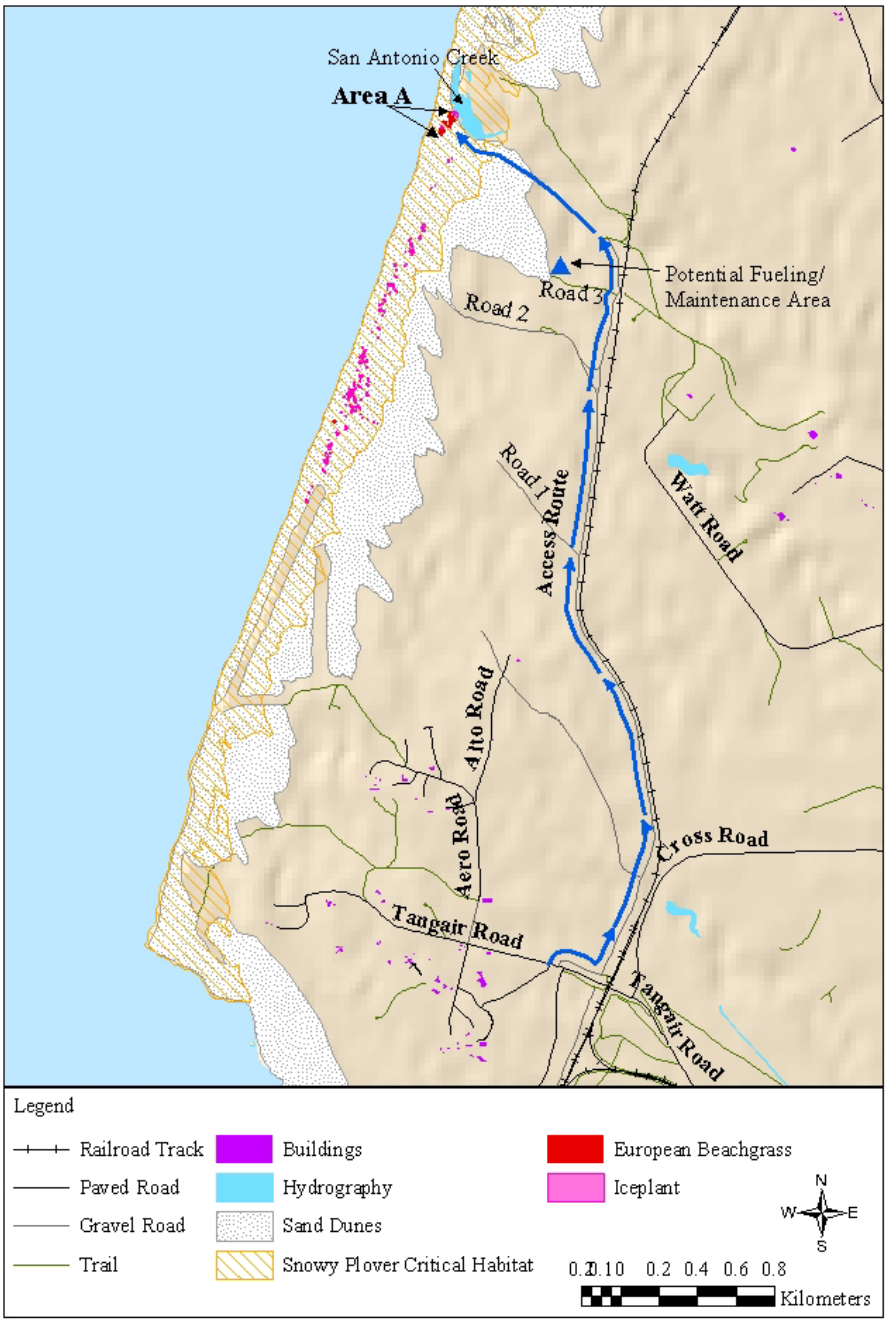

Figure 9. Recommended access route to Area A.

Area B - South End of San Antonio Beach

Area B is comprised of European beachgrass ridges (approximately 39 acres) at the south end of San Antonio Beach (Figure 10) and small patches of iceplant on the beachfront west of the ridges (less than 1 acre) Iceplant is not shown in Figure 10 as satellite coverage was unavailable in the area where the iceplant was present and hence GPS coverages could not be obtained.

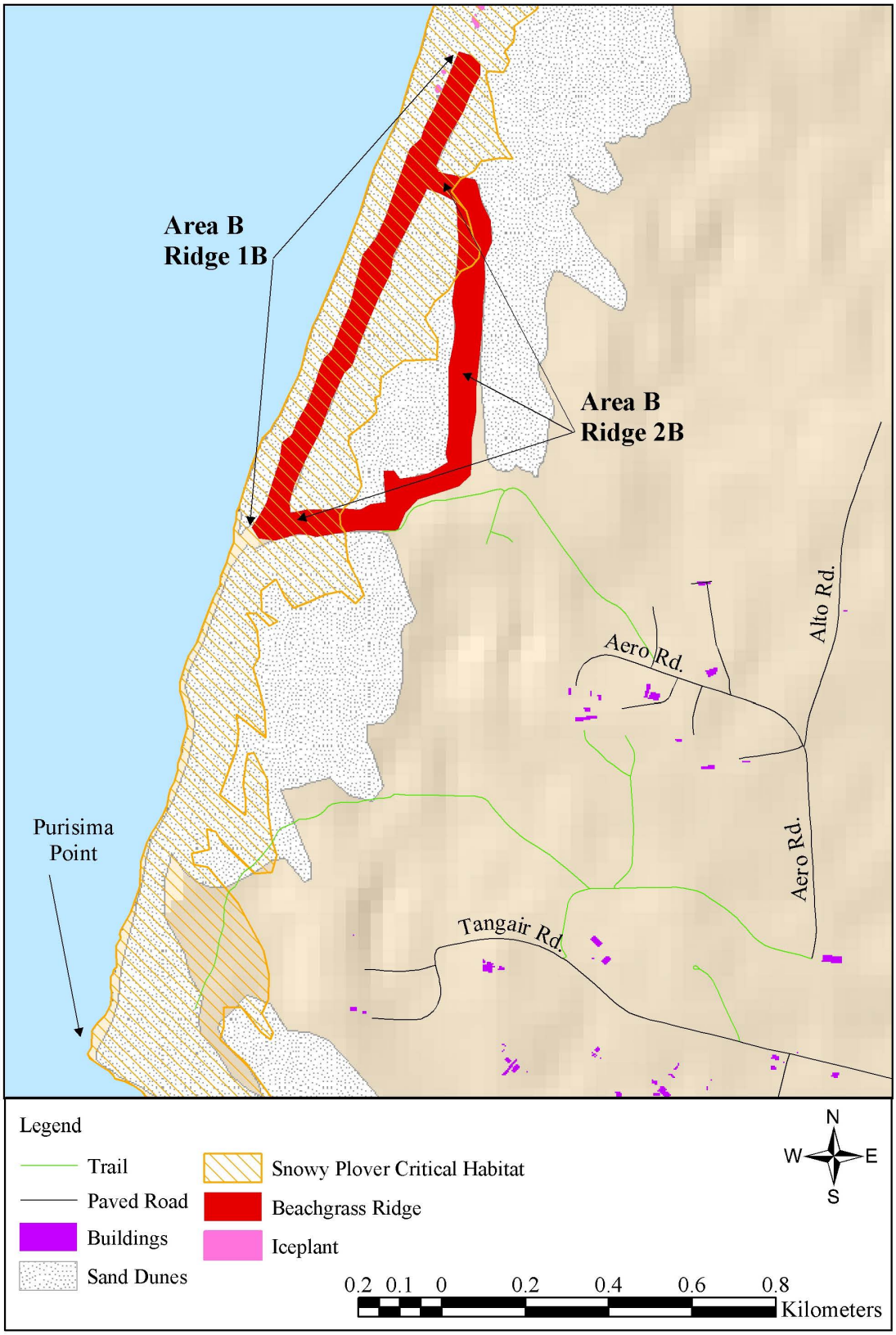

Figure 10. Area B, recommended for European beachgrass removal.

This section of beach is approximately 0.78 miles (1.25 kilometers) long and consists of two continuous beachgrass ridges that are approximately 164 feet (50 meters) wide, along with the patches of iceplant. Beachgrass was planted in this area (Purisima Point) between 1953 and 1960 as a part of an erosion control program (Earth Tech 2001) and this likely resulted in the formation of these ridges.

One ridge (designated Ridge 1B) separates the shore and open sand (Figure 11), and in some places extends 0.25 miles (400 meters) to the east. Ridge 1B runs the length of Area B. The second ridge (Ridge 2B) connects with Ridge 1B near the north end of Area B and extends due south until it grades into the densely vegetated backdunes located approximately 0.28 miles (450 meters) from the shoreline (Figure 12). Ridge 2B is approximately 0.43 miles (700 meters) long.

Figure 11. Ridge 1B (beachside view) separates the shore and open sand.

Figure 12. Ridge 2B grades into the densely vegetated backdunes.

Since these ridges developed before full season plover monitoring began on VAFB in 1994, there is no record of nesting activity in the area prior to this. In recent years there has been plover nesting activity on the narrow beachfront west of Ridge 1B. There has also been some nesting activity to the east of Ridge 1B and west of Ridge 2B. Nest numbers within the north/south boundaries of Area B (from 1994 to 2004, excluding 2000) have ranged from 1 in 1995, to 19 in 2004 (Persons 1995a, 1995b; Persons and Applegate 1996, 1997; Applegate and Schultz 1999, 2000, 2001; PRBO 2001; SRS Technologies 2002a, 2003, 2004).

Area B was selected because it is believed that the removal of the beachgrass and iceplant would result in higher use by nesting plovers through the creation of a large area of continuous habitat (Criteria 2) similar to the area heavily used by nesting plovers at the north end of San Antonio Beach. Once the beachgrass and iceplant are removed from this area, potential nesting habitat would extend to approximately 984 feet (300 meters) east of the beach. This area is bordered to the south and east with areas of extensive beachgrass infestation and would require constant maintenance to prevent re-infestation. This area incurs minimal human disturbance and is closed to recreation for the duration of the plover nesting season (Criteria 4).

In order to minimize/avoid impacts to cultural resources in Area B (Criteria 5), several tasks might need to be accomplished prior to invasive plant removal efforts. If mechanical removal is selected for invasive plant removal, a survey, boundary testing and testing for National Register of Historic Places eligibility would need to be performed. Additionally, consultation with the SHPO would occur after the site was assessed and a mitigation plan might be needed. There is no guarantee that SHPO will support removal efforts at this site. If manual removal and/or chemical removal are selected, the site might need to be surveyed and limited testing performed to define site boundaries before removal efforts began. Archaeological and Native American monitoring would also be necessary.

There is reasonable equipment access to the area via trail access, as described below (Criteria 6).

No documentation was found that identified this area for earlier eradication efforts.

Mechanical removal would be recommended in Area B for the initial treatment of the two beachgrass ridges for two reasons: the large size of the area to be treated, and the level of effort needed to restore the area to its assumed pre-beachgrass topography.

Equipment would be driven, as far as possible, on existing roads through the Space Launch Complex (SLC)-10. One of these existing abandoned roads, which veers off of Aero Road, extends westward to the east side of Ridge 2B (Figure 13). At the end of the road, the equipment would continue westward toward the project site driving on the open sand and/or the beachgrass ridges that cross the area. Work would begin at the northernmost point of the ridge and continue on a southerly course to reduce the need to re-enter an area where work has been completed. A potential fueling/maintenance area is located off Piro Road (Figure 13), and is approximately 1 kilometer from the southern end of Ridge 2B.

Application of herbicide would be the preferred treatment method for the small patches of iceplant in Area B, as long as native plant coverage was found to be less than 40%. Dead plant matter would be left in place. Herbicides would be transported and applied at the site with backpack sprayers.

There are some special considerations that would need to be considered if project activities are elected to occur at Area B.

In the 1950's, VAFB was known as Camp Cooke. It was an Army Post primarily used for training troops for combat in Korea. As part of this training, large quantities of ordnance were delivered into areas known as Impact Ranges. The area between San Antonio Creek and Purisima Point, including Area B, was used as an Artillery Impact Range. Therefore, prior to any mechanical removal or follow-up treatments in Area B, the area would need to be cleared of unexploded ordnance by VAFB 30 CES Explosive Ordnance Disposal (EOD) personnel.

Informal communication with VAFB EOD indicates that an approximate 2-month lead-time would be required to clear an area to a depth of 3 to 4 feet. This would require several sweeps by ordnance detectors in areas where a significant amount of sand removal would occur. Specifically the dune ridge would have to be scanned, some material removed, and then rescanned every time sand is removed to a specific depth. Additionally, access routes and staging areas will need to be scanned for buried ordinance.

For Area B, we recommend that sprayed iceplant be left in place and the beachgrass be screened to remove excess sand and trucked to the VAFB landfill. Once the beachgrass has been removed, the dunes in the area would be restructured. As described above, dune restructuring or leveling (beyond what occurs during vegetation removal) would require EOD to scan after each 3 to 4 feet of sand was removed, as their equipment can only detect ordinance to a depth of 3 to 4 feet. Dunes in this area are approximately 25 feet high, with some falling above and some below this height. Active revegetation as previously described previously would be recommended for this area where heavy equipment work would take place.

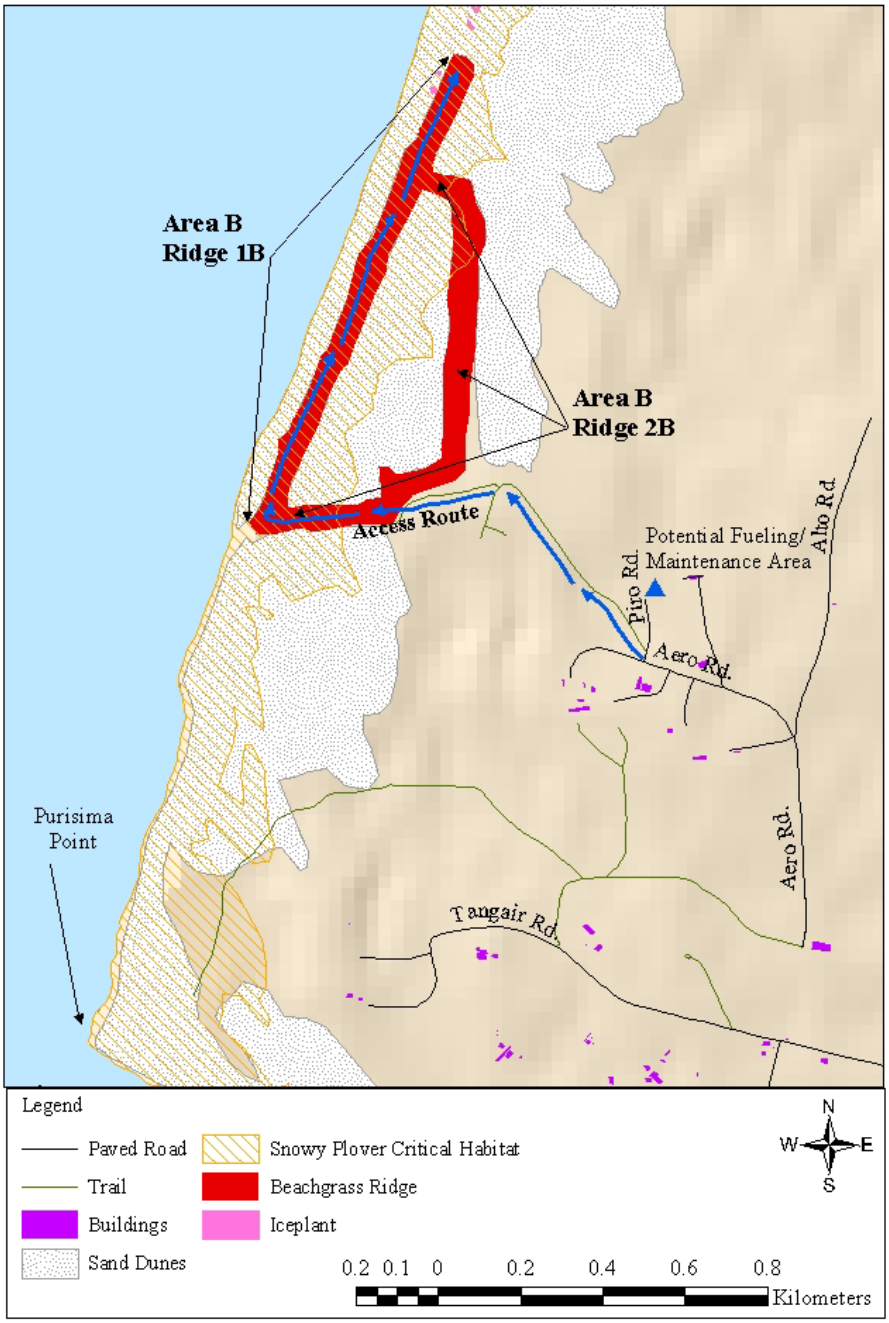

Figure 13. Recommended access Route to Area B.

Area C - San Antonio Beach between Areas A and B

This area, located between Areas A and B (Figure 14 and Figure 15), consists of many relatively small patches of iceplant infestation (approximately 2 acres) and some beachgrass (less than 1 acre). Nest numbers within the north/south boundaries of Area C (from 1994 to 2004, excluding 2000) have ranged from 10 in 1999 to 73 in 2004 (Persons 1995a, 1995b; Persons and Applegate

1996, 1997; Applegate and Schultz 1999, 2000, 2001; PRBO 2001; SRS Technologies 2002a, 2003, 2004).

While this nesting area is not densely infested with iceplant or beachgrass, it was selected in order to protect it from further degradation by exotic vegetation currently existing in the area (Criteria 1). Without treatment, it is possible that the sand in this area would become more stabilized by vegetation, creating unfavorable topography, and the vegetation itself would become so dense as to eventually preclude the use of the area for nesting by plovers. Area C incurs minimal human disturbance and is closed to recreation for the duration of the plover nesting season (Criteria 4). No archeological or Native American monitoring is expected to be required at this site (Criteria 5) if only herbicide treatment is used, as described for the suggested treatment method below. Archaeological and Native American monitoring would be necessary if manual removal was selected. There is reasonable equipment access to the area via trail access, as described below (Criteria 6).

Area C includes the isolated beachgrass infestation mentioned by USFWS (1995) in their Recommended Eradication Sites. It was described as follows:

> Four hundred (400) meters [0.25 miles] south of that location [south of the mouth of San Antonio Creek] is an isolated patch of European beachgrass that could also be removed and eliminated as a potential source in an otherwise European beachgrass-free section of habitat. The beach (and nesting area) is then free of European beachgrass for another kilometer [0.62 miles] south until a large stand of source [material] is noted.

Currently, it is believed that the "isolated patch" referred to in the 1995 document is now a 29.5 feet (9 meter)-diameter dune with smaller 3.3 feet (1 meter) hummocks to the north and south. It is proposed that the beachgrass on this dune be removed manually and that the dune not be re-vegetated. This recommendation is based on the small size of the dune, its distance from an area of mechanical clearing, the proximity of existing native vegetation, and the likelihood that the wind would reduce its size through erosion.

The rest of this area has not accumulated sand to an extent that the dune structure requires altering in order to be returned to a natural orientation. Therefore, application of herbicide would be the preferred treatment method in Area C, other than as described for the beachgrass dune above, and as long as native plant coverage was found to be less than 40%. Dead plant matter would be left in place. Herbicides would be transported and applied at the site with backpack sprayers.

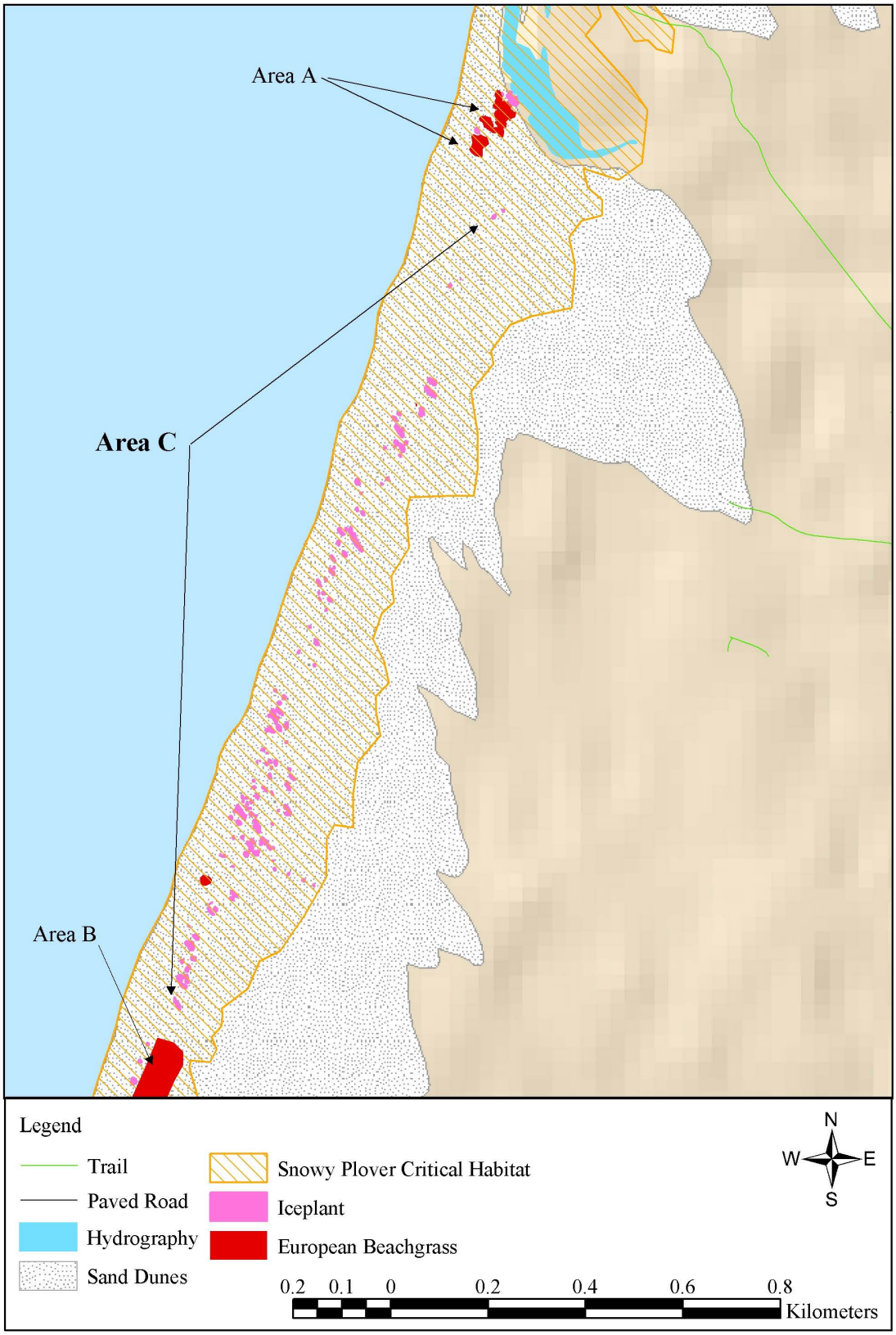

Figure 14. Area C, recommended for iceplant and European beachgrass removal.

Figure 15. Representative view of Area C, comprised of many small patches of iceplant infestation and some beachgrass.

Access to these areas would be by foot or ATV. There are several access trails to the east of this beach section (Figure 16) and their trailheads are located at the ends of Road 2 and Road 3. The access trail used for Area A can also be used to reach the northern extent of this area. A potential fueling/maintenance area is located on Road 3 along the access route and is approximately 0.7 kilometers from Area C (Figure 16). Since the herbicide application would be selectively sprayed only on invasive species, native species would remain and there would be no need for revegetation in Area C.

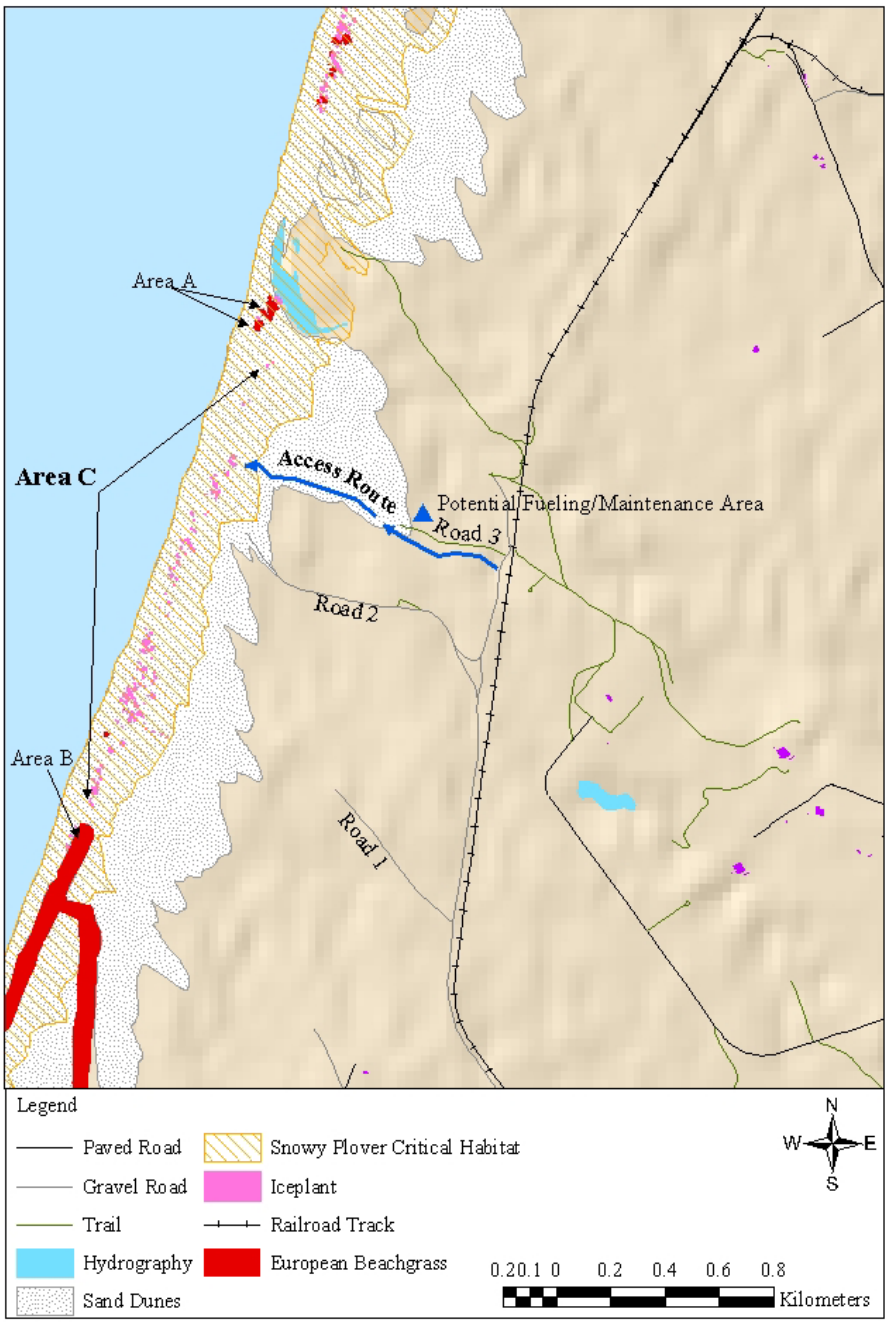

Figure 16. Recommended access route to Area C.

Area D - Surf Beach North (Ocean Park to Surf Station)

Area D (Figure 17) extends from the Santa Ynez River mouth southward approximately 0.62 miles (1 kilometer) to a point approximately 164 feet (50 meters) south of the public access trail at Surf Station. The infestation of beachgrass in this area covers approximately 22 acres. Iceplant (less than 1 acre) is found in isolated patches throughout this section and in dense mats to the southern end. Beach grass density varies throughout this section, but in general is lower at the north end and higher at the south end.

Dune structure also varies along this section, with the dunes being slightly lower and spaced out to the north (Figure 18), and forming a mostly uniform ridge that is approximately 15 foot high, to the south. Plover nest numbers within the north/south boundaries of Area D (from 1994 to 2004, excluding 2000) have ranged from 4 in 1998 to 91 in 2004 (Persons 1995a, 1995b; Persons and Applegate 1996, 1997; Applegate and Schultz 1999, 2000, 2001; PRBO 2001; SRS Technologies 2002a, 2003, 2004).

Area D is recommended for treatment because, with the suggested treatment, a 35 percent increase in available nesting habitat would result (Criteria 2). Archeological and Native American monitoring should be sufficient measures to ensure potential impacts to cultural resources are minimized/avoided in areas where mechanical or manual treatments would be used (Criteria 5). Areas at this site where chemical treatment would be used should not require cultural resource monitoring. Additionally, there is reasonable equipment access to the area (Criteria 6), although some coordination with Southern Pacific Railroad would be necessary as described below.

A portion of Area D was previously recommended to be targeted for eradication (USFWS 1995) and was described as follows:

> The area south of Surf Station has a lot of [beachgrass] patches that are close to source material. This source/patch proximity would generally preclude the area from consideration, however the western snowy plover nesting habitat is extremely narrow here and may be at the threshold of suitability. Small, even temporary, gains could prove beneficial.

The source for beachgrass mentioned in USFWS (1995) appears to be the beachgrass to the north of the Surf Station access trail. Our recommended action in Area D would eliminate this source, in addition to the area suggested by the USFWS. Our action would provide for a more sustainable restoration effort.

Treatment throughout Area D would vary with dune structure, dune composition, and public use. It is recommended that all three treatment types, manual, chemical and mechanical, be employed in this area.

The large densely vegetated beachgrass dunes and the beachgrass ridge that extends the length of the southern half of this area would be removed with heavy equipment, as previously described in this document. Revegetation would be recommended in Area D where heavy equipment would be used and would follow guidelines as described in the Methods section.

Heavy equipment access to the project site would need to be coordinated with Southern Pacific Railroad and may consist of constructing a temporary railroad crossing for access near the Ocean Beach County Park parking lot (Figure 17), creating a temporary railroad crossing just to the north of Surf Station, accessing the beach through the current crossing at Surf Station, or a combination of the above. A fueling and maintenance area could be stationed near the Ocean Beach County Park parking lot.

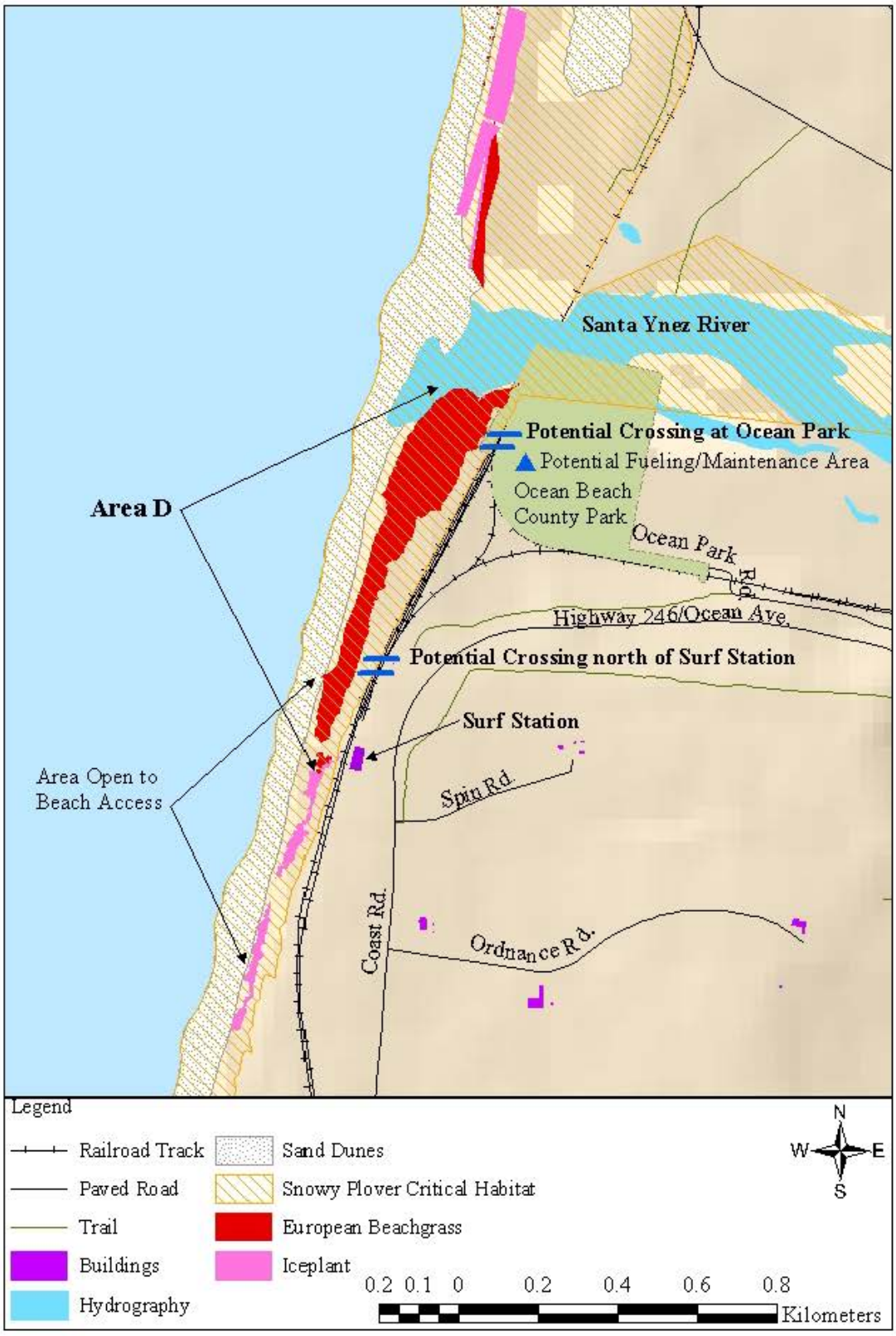

Figure 17. Area D, recommended for European beachgrass removal, and potential temporary railroad crossing sites.

Figure 18. Beachgrass dunes present in northern portion of Area D.

Alternative access available outside of plover breeding season could include access from Wall Beach (see Figure 2). When the sand bar at the Santa Ynez River is still in place and tides are not high, equipment could access Area D by driving south approximately 1 mile (1.6 kilometers) along Wall Beach after entering from the Wall Beach parking lot. This route could potentially be used if the primary access route crossing the railroad track is not available for a period of time.

The iceplant and beachgrass removed mechanically would be sifted to remove excess sand and trucked to the VAFB landfill. The excavated sand would be recommended for regular deposition at the mean high tide line during low tide, or trucked off site.

Chemical treatment in Area D would be used where dune structure does not need to be altered and where iceplant coverage exceeds 60 percent of the vegetation in the hummocks. Dead vegetation, in isolated patches, would be left in place to be covered with blowing sand, or be revegetated naturally from nearby native plants. Dead vegetation would be removed by hand in areas greater than 0.1 acres (400 m^2) that consist of dense invasive vegetation, to make the area more characteristic of plover nesting habitat. This treatment would be used mostly in the northern and central portion of Area D.

Manual removal would be used in areas where native plant species coverage is greater than or equal to or greater than 40 percent of the total vegetation cover, and where dune structure doesn't need to be altered. These conditions mainly occur in the northern portion of Area D. Revegetation would not be required where manual treatment is employed.

Sites Previously Recommended for Eradication

USFWS (1995) recommended the following area for eradication:

> North of San Antonio River mouth, there are 3 relatively small, isolated stands of European beachgrass which should be removed."

This proposed project does not recommend inclusion of this site for restoration for the following reasons: The beach and nesting habitat immediately to the north of the San Antonio River is significantly narrower than to the south. Even the foredunes in this area with native vegetation are consistently taller and more concentrated than those found in "textbook" plover nesting areas. Removal of beachgrass in this area would not be expected to significantly improve the area for plover habitat.

PROPOSED PROJECT SCHEDULE

The following tables (Table 3 and Table 4) provide a proposed schedule for project activities. Active restoration activities would be proposed to take place during the initial 5-year period, with re-treatment, monitoring and reporting activities taking place during the following 5-year period.

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ACTIVITIES	ACTIONS TO BE COMPLETED PRIOR TO PROJECT INITIATION	PROJECT YEAR 1 - Active Restoration						PROJECT YEAR 2 - Active Restoration						PROJECT YEAR 3 - Active Restoration						PROJECT YEAR 4 - Active Restoration						PROJECT YEAR 5 - Active Restoration					
		1 Mar - 30 Sep	Oct	Nov	Dec	Jan	Feb	1 Mar - 30 Sep	Oct	Nov	Dec	Jan	Feb	1 Mar - 30 Sep	Oct	Nov	Dec	Jan	Feb	1 Mar - 30 Sep	Oct	Nov	Dec	Jan	Feb	1 Mar - 30 Sep	Oct	Nov	Dec	Jan	Feb
Pre-Restoration Activities/Permitting/Surveys																															
Finalize plan actions and details	X																														
Prepare EA/EIS as necessary	X																														
Obtain permits/approvals/consultations as necessary	X																														
Restoration Activities																															
Initial vegetation surveys for special status plants	X						X						X						X						X						
Follow-up surveys for special status plants, as necessary		X						X						X						X						X					
Seed collection in areas where heavy equipment will be used, as necessary		X						X						X						X						X					
Flagging of special status plants in areas selected for restoration/Terrestrial wildlife surveys to note presence of special status species and note need for relocation, avoidance, and/or halt in activity			X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Weed Control Treatment			X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Dune restructuring			X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Disposal of sand and vegetative biomass			X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Revegetation, as necessary									X	X					X	X					X	X					X	X			
Follow-up Monitoring/Retreatment/Reporting																															
Re-infestation and native species monitoring				X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Manual retreatment of iceplant and beachgrass, and chemical retreatment of iceplant, as necessary				X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Chemical retreatement of beachgrass, as necessary							X						X						X						X						X
Nesting/chick rearing/fledging success monitoring		X						X						X						X						X					
Reporting			X					X	X					X	X					X	X					X	X				
Note: X indicates the available timeframe for an activity; however an activity will not necessarily occur during each and every available timeframe.																															

Table 3. Proposed project schedule for Years 1 to 5, including most of active restoration efforts.

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ACTIVITIES	PROJECT YEAR 6 - Post Restoration		PROJECT YEAR 7 - Post Restoration		PROJECT YEAR 8 - Post Restoration		PROJECT YEAR 9 - Post Restoration		PROJECT YEAR 10 - Post Restoration	
	1 Mar - 30 Sep	1 Oct - 28 Feb	1 Mar - 30 Sep	1 Oct - 28 Feb	1 Mar - 30 Sep	1 Oct - 28 Feb	1 Mar - 30 Sep	1 Oct - 28 Feb	1 Mar - 30 Sep	1 Oct - 28 Feb
Pre-Restoration Activities/Permitting/Surveys										
Finalize plan actions and details										
Prepare EA/EIS as necessary										
Obtain permits/approvals/consultations as necessary										
Restoration Activities										
Initial vegetation surveys for special status plants										
Follow-up surveys for special status plants, as necessary										
Seed collection in areas where heavy equipment will be used, as necessary										
Flagging of special status plants in areas selected for restoration/Terrestrial wildlife surveys to note presence of special status species and note need for relocation, avoidance, and/or halt in activity										
Weed Control Treatment										
Dune restructuring										
Disposal of sand and vegetative biomass										
Revegetation, as necessary		X								
Follow-up Monitoring/Retreatment/Reporting										
Re-infestation and native species monitoring		X		X		X		X		X
Manual retreatment of iceplant and beachgrass, and chemical retreatment of iceplant, as necessary		X		X		X		X		X
Chemical retreatement of beachgrass, as necessary		X		X		X		X		X
Nesting/chick rearing/fledging success monitoring	X		X		X		X		X	
Reporting		X		X		X		X		X
Note: X indicates the available timeframe for an activity; however an activity will not necessarily occur during each and every available timeframe.										

Table 4. Proposed project schedule for Years 6 to 10, including post-restoration activities and monitoring.

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CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

While removal of exotic plant species from the selected areas is a large undertaking, we believe that this action would improve snowy plover nesting areas within designated critical habitat.

As re-infestation by invasive species is highly likely if source material is nearby and no maintenance is provided, we strongly recommend that treated areas be designated by VAFB for long-term habitat management, which would include continued maintenance.

In addition, future efforts to consider would include further treatment of source material that is immediately adjacent to treated areas, or in other areas on VAFB that have previously shown high historic nesting rates.

Additional monitoring of treated sites for native plant emergence in non-revegetated areas and plant survivability in re-vegetated areas could also be studied.

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REFERENCES

Applegate, T.E., and S.J. Schultz. 1999. Western Snowy Plover Monitoring on Vandenberg Air Force Base. 1998 Final Report. Unpubl. Report. BioResources Biological Consulting, Los Osos, CA. 31 pp.

Applegate, T.E., and S.J. Schultz. 2000. Western Snowy Plover Monitoring on Vandenberg Air Force Base. 1999 Final Report. Unpubl. Report. BioResources Biological Consulting, Los Osos, CA. 23 pp.

Applegate, T.E., and S.J. Schultz. 2001. Western Snowy Plovers on Vandenberg Air Force Base. 2000 Final Report. Unpubl. Report. BioResources Biological Consulting, Los Osos, CA. 28 pp.

Aptekar, R. 1999. The ecology and control of European beachgrass (Ammophila arenaria). Ph.D. dissertation, University of California, Davis, CA.

Barbour, M.G. and A.F. Johnson. 1988. Beach and dune. In: Barbour, M.G. and J. Major (eds.). Terrestrial Vegetation of California. John Wiley & Sons, New York, NY.

Barbour, M.G. and J. Major. 1990. Terrestrial vegetation of California. California Native Plant Society. Special Publication Number 9, University of Davis, CA> 1028 pp.

Bossard, C.C., J.M. Randall, and M.C. Hoshovsky (eds.). 2000. Invasive Plant of California's Wildlands. University of California Press. Berkeley. 360 pp.

California Department of Parks and Recreation. 1992. Contract No. 88-17-017 with Thomas Reid Associates. Unpublished document. California Department of Parks and Recreation, Monterey District, CA.

Chestnut, John. 1999. Final draft of A Review of Weed Threats to the Nipomo Dunes. Prepared for the Land Conservancy of San Luis Obispo, April 1, 1999.

Collier, N., D. Robinette, and W.J. Sydeman. 2002. Brown Pelican roost utilization along the coastal margin of Vandenberg Air Force Base, January 1995 through December 1995, December 1999 through December 2000, and February 2001 through January 2002. Unpublished Report, Point Reyes Bird Observatory, Stinson Beach, CA.

Cooper, W.S. 1967. Coastal sand dunes of California. Geological Society of America. 104:1-131.

D'Antonio, C.M. 1990a. Invasion of coastal plan communities in California by the introduced iceplant, Carpobrotus edulis (Aizoaceas). Ph.D. dissertation, University of California, Santa Barbara, CA.

D'Antonio, C.M. 1990b. Seed production and dispersal in the non-native, invasive succulent Carpobrotus edulis in coastal strand communities of central California. J. Applied Ecology. 27:693-702.

Department of Fish and Game (DFG). 2000. The Status of Rare, Threatened, and Endangered Animals and Plants of California 2000.

Earth Tech, Inc. 2001. Exotic Plant Management Report. Vandenberg Air Force Base. September 2001. Prepared for the Air Force Center of Environmental Excellence. 48 pp.

Earth Tech Inc., SAIC, and FLx. 1996. Final Report of the Successful Creation of Wetlands and Restoration of Uplands at San Antonio Terrace, Vandenberg Air Force Base, California. Peacekeeper Rail Garrison and Small ICBM Mitigation Program. February 1996.

Ferreira, J., and S. Smith. 1987. Methods of increasing native populations of *Erysimum menziesii*. Pages 507-11 in T. Elias, ed. Conservation and management of rare and endangered plants. California Native Plant Society, Sacrament, CA.

Hall, L.S., P.R. Krausman, and M.L. Morrison. 1997. The habitat concept and a plea for standard terminology. Wildlife Society Bulletin 1997, 25(1);173-182.

Holland, V.L. and D.J. Keil. 1995. California Vegetation. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Huiskes, A.H. 1979. Biological flora of the British Isles: *Ammophila arenaria* (L.) Link. J. of Ecology. 67:363-82.

Keil, D.J., and V.L. Holland. 1998. Documented Flora of Vandenberg Air Force Base, Santa Barbara County, California. Prepared for The Nature Conservancy and Vandenberg Air Force Base, 27 June 1998. 97pp.

Moody, M.E. and Mack, R.N. 1988. Controlling the spread of plant invasions: the importance of nascent foci. Journal of Applied Ecology, 25: 1009-1021.

Oregon Department of Fish and Wildlife. 1996. Snowy plover habitat restoration on the Coos Bay North Spit using inmate labor. 21 pp.

Page, G.W. and L.E. Stenzel (eds.). 1981. The breeding status of the snowy plover in California. Western Birds 12(1):1-40.

Page, G.W., and P.E. Persons. 1995. The snowy plover at Vandenberg Air Force Base: Population size, reproductive success, and management. Unpublished Report, Stinson Beach, CA. 29pp.

Page, G.W., J.S. and J.C. Warriner, and P.W.C. Paton. 1995. Snowy plover (*Charadrius alexandrinus*). In The Birds of North America, No. 154, (A. Poole and F. Gill, eds.).

The Academy of Natural Sciences, Philadelphia, PA, and the American Ornithologists' Union, Washington DC.

Persons, P.E. 1995a. Western Snowy Plover Population Size and Nesting Success in 1994 at Vandenberg Air Force Base, California. A Monitoring Report Prepared For U.S. Fish and Wildlife Service Ventura Field Station Ventura, California. Unpubl. Report. January 1995.

Persons, P.E. 1995b. Western Snowy Plover Population Size and Reproductive Success in 1995 at Vandenberg Air Force Base, California. Point Reyes Bird Observatory, Stinson Beach, CA. November 1995. 23 pp.

Persons, P.E., and T.E. Applegate. 1996. Western Snowy Plover Population Size and Reproductive Success in 1996 at Vandenberg Air Force Base, California. Unpubl. Report. Point Reyes Bird Observatory, Stinson Beach, CA. 35 pp.

Persons, P.E., and T.E. Applegate. 1997. Monitoring of the Western Snowy Plover at Vandenberg Air Force Base in 1997: Population Size, Reproductive Success, and Management. Unpubl. Report. Point Reyes Bird Observatory, Stinson Beach, CA. 30 pp.

Peterson, B., Bromberg, J. and K. Cooper. 2003. Coastal Dune Restoration (PMIS# 60235), Point Reyes National Seashore. Final Report. October 2003.

Pickart, A.J., Brown, D.R., and Avery, W. 1990. Experimental eradication of European beachgrass (Ammophila arenaria) Humboldt County, California. The Nature Conservancy, 6800 Lanphere Rd., Arcata CA 95521. (Unpublished)

Pickart, A.J. 1997. Control of European Beachgrass (Ammophila arenaria) on the West Coast of the United States. 1997 Symposium Proceedings for the California Exotic Pest Plant Council. 8 pp.

Pickart, A.J. and J.O. Sawyer. 1998. Removal of invasive plants from coastal dunes. Ecology and Restoration of Northern California Coastal Dunes, Chapter 4. California Native Plant Society, Sacramento, CA.

Powell, A.N., B.L. Peterson, and J.M. Terp. 1996. The status of western snowy plovers (Charadrius alexandrinus nivosus) in San Diego County, 1996. Report to the California Department of Fish and Game, Sacramento, CA, and U.S. Fish and Wildlife Service, Carlsbad, CA, and Portland, OR. 25 pp.

Powell, A.M., J.M. Terp, C.L. Collier, and B.L. Peterson. 1995. The status of western snowy plovers (Charadrius alexandrinus nivosus) in San Diego County, 1995. Report to the California Department of Fish and Game, Sacramento, CA, and U.S. Fish and Wildlife Service, Carlsbad, CA, and Portland, OR. 34 pp.

Point Reyes Bird Observatory (PRBO). 2001. Nesting of the western snowy plover on Vandenberg Air Force Base in 2001, 2001 Final Report. Unpublished Report, Stinson Beach, CA. 48 pp.

Science Applications International Corporation (SAIC). 2001. Draft Habitat Restoration Plan for the Western Snowy Plover on Vandenberg AFB, California. September 2001. 34 pp.

SRS Technologies. 2002a. Breeding activities of the western snowy plover (Charadrius alexandrinus nivosus) on Vandenberg Air Force Base, California. 2002 Final Report. Unpublished Report, Lompoc, California. 59 pp.

SRS Technologies. 2002b. Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launch at Vandenberg Air Force Base, California for the Period from 1 January to 31 December 2001. SRS Technologies Technical Report, submitted to the United States Air Force and the National Marine Fisheries Service. March 2002. 20 pp.

SRS Technologies. 2003. Breeding activities of the western snowy plover (Charadrius alexandrinus nivosus) on Vandenberg Air Force Base, California. 2003 Final Report. Unpublished Report, Lompoc, California. 58 pp.

SRS Technologies. 2004. Breeding activities of the western snowy plover (Charadrius alexandrinus nivosus) on Vandenberg Air Force Base, California. 2004 Final Report. Unpublished Report, Lompoc, California. 58 pp.

Stenzel, L.E., S.C. Peaslee, and G.W. Page. 1981. II. Mainland Coast. Pages 6-16 in Page, G.W. and L.E. Stenzel, (Eds.). The breeding status of the snowy plover in California. Western Birds 12(1):1-40.

Theiss, K.C. 1994. Methods for removal of Carpobrotus edulis from coastal dunes, Humboldt County. Unpublished document. The Nature Conservancy, Arcata, CA.

Titus, R.G, and D.C Erman. 1993. Historic Review and Current Status of California Steelhead in Coastal Drainages South of San Francisco Bay. Department of Forestry and Resource Management, University of California, Berkeley.

The Nature Conservancy (TNC). 2001. The Nature Conservancy Site Weed Management Plan Template. Revised by M. Tu and B. Meyers-Rice/WISP. Updated July 2001.

Tu, M., Hurd, C., & J.M. Randall, 2001. Weed Control Methods Handbook, The Nature Conservancy, http://tncweeds.ucdavis.edu, Version: April 2001.

USAF. 2000. Draft Environmental Assessment for Beach Management and the Western Snowy Plover at Vandenberg Air Force Base, California. Prepared for the Department of the Air Force, 30th Space Wing. Submitted by SRS Technologies, October 2000.

USAF. 2003. Final Draft Integrated Natural Resources Management Plan Vandenberg Air Force Base California. Plan Period 2003-2008. Prepared for 30 CES/CEV. Submitted by SRS Technologies, February 2003.

USDA Forest Service. 1995. Environmental assessment, snowy plover/pink sand verbena habitat restoration. Unpublished document. USDA Forest Service, Siuslaw National Forest, Oregon Dunes National Recreation Area. Prepared by Daniel E. Segotta.

USDA Forest Service. Undated. Environmental assessment, snowy plover/pink sand verbena habitat restoration. Unpublished document. USDA Forest Service, Siuslaw National Forest, Mapelton Ranger District, Mercer/Berry Watershed. Responsible Official: Bill Helphinstine, District Ranger.

USFWS. 1993. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pacific Coast Population of the Western Snowy Plover; Final rule. Federal Register, 50 CFR Part 17: 12864-12874.

USFWS. 1995. European Beach Grass Surveys Within Western Snowy Plover Nesting Habitat At Vandenberg Air Force Base, Santa Barbara County, California. Prepared for U.S. Air Force Vandenberg Air Force Base, 19 October 1995. Prepared by Laye, D., and L. Mangione of the U.S. Fish and Wildlife Service, Ecological Services, Ventura Field Office.

USFWS. 1999. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover; Final rule. Federal Register, 50 CFR Part 17:68507-68544.

USFWS. 2001a. Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Portland, Oregon. xix + 630 pp.

USFWS. 2001b. Biological Opinion for Beach Management and the Western Snowy Plover on Vandenberg Air Force Base for the 2001 Breeding Season (1-8-01-F-13). Letter to Colonel Stephen Lanning, Commander 30 Space Wing, dated 9 March 2001 from Diane K. Noda, Field Supervisor, U.S. Fish and Wildlife Service. 34 pp.

USFWS. 2002. Comments on Habitat Restoration Plan for the Western Snowy Plover, Vandenberg Air Force Base, California. Letter to Lieutenant Colonel Scott W. Westfall, Commander, Environmental Flight 30 CES/CEV, dated 16 September 2002, from Diane K. Noda, Field Supervisor, U.S. Fish and Wildlife Service. 2 pp.

Vandenberg Air Force Base. 2000. General Plan.

Widrig, R.S. 1980. Snowy plovers at Leadbetter Point: An opportunity for wildlife management? Prepared for the U.S. Fish and wildlife Service, Willapa NWR, Ilwaco, WA. 14 pp.

Wiedemann, A.M., and A.J. Pickart. 1996. The Ammophila problem on the Northwest coast of North America. Landscape and Urban Planning 34:287-299.

Wiedemann, A.M., L.J. Dennis, And F.H. Smith. 1969. Plants of the Oregon coastal dunes. Department of Botany, Oregon State University. Oregon State University Book Stores, Inc., Corvallis, OR. 117 pp.

Wilson, R.A. 1980. Snowy plover nesting ecology on the Oregon coast. MS Thesis, Oregon State University, Corvallis. 41 pp.

APPENDIX 1 - Label for Roundup PRO Concentrate

MONSANTO Company
Material Safety Data Sheet
Commercial Product

1. PRODUCT AND COMPANY IDENTIFICATION

Product name
ROUNDUP PRO® Herbicide

EPA Reg. No.
524-475
Product use
Herbicide
Chemical name
Not applicable
Synonyms
None
Company
MONSANTO Company, 800 N. Lindbergh Blvd., St. Louis , MO, 63167
Telephone: 800-332-3111, **Fax:** 314-694-5557
Emergency numbers
FOR CHEMICAL EMERGENCY, SPILL LEAK, FIRE, EXPOSURE, OR ACCIDENT Call CHEMTREC - Day or Night: 1-800-424-9300 toll free in the continental U.S., Puerto Rico, Canada, or Virgin Islands. For calls originating elsewhere: 703-527-3887 (collect calls accepted).
FOR MEDICAL EMERGENCY - Day or Night: 314-694-4000 (collect calls accepted).

2. COMPOSITION/INFORMATION ON INGREDIENTS

Active ingredient
Isopropylamine salt of N-(phosphonomethyl)glycine; {Isopropylamine salt of glyphosate}

Composition

COMPONENT	CAS No.	% by weight (approximate)
Isopropylamine salt of glyphosate	38641-94-0	41
Surfactant		14.5
Water and minor formulating ingredients		44.5

OSHA Status
This product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

Emergency overview
Appearance and odour (colour/form/odour): Clear - Amber / Liquid / Sweet

CAUTION!
CAUSES EYE IRRITATION

Potential health effects
Likely routes of exposure
Skin contact, eye contact

Eye contact, short term
May cause temporary eye irritation.
Skin contact, short term
Not expected to produce significant adverse effects when recommended use instructions are followed.
Inhalation, short term
Not expected to produce significant adverse effects when recommended use instructions are followed.

Refer to section 11 for toxicological and section 12 for environmental information.

4. FIRST AID MEASURES

Eye contact
Immediately flush with plenty of water.
If easy to do, remove contact lenses.

Skin contact
Take off contaminated clothing, wristwatch, jewellery.
Wash affected skin with plenty of water.
Wash clothes before re-use.

Inhalation
Remove to fresh air.

Ingestion
Immediately offer water to drink.
Do NOT induce vomiting unless directed by medical personnel.
If symptoms occur, get medical attention.

Advice to doctors
This product is not an inhibitor of cholinesterase.

Antidote
Treatment with atropine and oximes is not indicated.

5. FIRE FIGHTING MEASURES

Flash point
none

Extinguishing media
Recommended: Water, foam, dry chemical, carbon dioxide (CO2)

Unusual fire and explosion hazards
Minimize use of water to prevent environmental contamination.
Environmental precautions: see section 6.

Hazardous products of combustion
Carbon monoxide (CO), phosphorus oxides (PxOy), nitrogen oxides (NOx)

Fire fighting equipment
Self-contained breathing apparatus.
Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protection recommended in section 8.

Environmental precautions

SMALL QUANTITIES:
Low environmental hazard.
LARGE QUANTITIES:
Minimize spread.
Keep out of drains, sewers, ditches and water ways.
Notify authorities.

Methods for cleaning up

SMALL QUANTITIES:
Flush spill area with water.
LARGE QUANTITIES:
Absorb in earth, sand or absorbent material.
Dig up heavily contaminated soil.
Collect in containers for disposal.
Refer to section 7 for types of containers.
Flush residues with small quantities of water.
Minimize use of water to prevent environmental contamination.

Refer to section 13 for disposal of spilled material.

7. HANDLING AND STORAGE

Good industrial practice in housekeeping and personal hygiene should be followed.

Handling

When using do not eat, drink or smoke.
Wash hands thoroughly after handling or contact.
Thoroughly clean equipment after use.
Do not contaminate drains, sewers and water ways when disposing of equipment rinse water.
Emptied containers retain vapour and product residue.
Refer to section 13 for disposal of rinse water.
Observe all labelled safeguards until container is cleaned, reconditioned or destroyed.

Storage

Minimum storage temperature: -15 °C
Maximum storage temperature: 50 °C
Compatible materials for storage: stainless steel, aluminium, fibreglass, plastic, glass lining
Incompatible materials for storage: galvanised steel, unlined mild steel, see section 10.
Keep out of reach of children.
Keep away from food, drink and animal feed.
Keep only in the original container.
Partial crystallization may occur on prolonged storage below the minimum storage temperature.
If frozen, place in warm room and shake frequently to put back into solution.
Minimum shelf life: 5 years.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Airborne exposure limits

Components	Exposure Guidelines
Isopropylamine salt of glyphosate	No specific occupational exposure limit has been established.
Surfactant	No specific occupational exposure limit has been established.
Water and minor formulating ingredients	No specific occupational exposure limit has been established.

Engineering controls

No special requirement when used as recommended.

Eye protection

No special requirement when used as recommended.

Skin protection

If repeated or prolonged contact:
Wear chemical resistant gloves.

Respiratory protection

No special requirement when used as recommended.

When recommended, consult manufacturer of personal protective equipment for the appropriate type of equipment for a given application.

9. PHYSICAL AND CHEMICAL PROPERTIES

These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

Colour/colour range:	Clear - Amber
Form:	Liquid
Odour:	Sweet
Flash point:	none
Specific gravity:	1.169 @ 20 °C / 15.6 °C
Solubility:	Water: Completely miscible.
pH:	4.4 - 5.0
Partition coefficient (log Pow):	< 0.00 (active ingredient)

10. STABILITY AND REACTIVITY

Stability

Stable under normal conditions of handling and storage.

Hazardous decomposition

Thermal decomposition: Hazardous products of combustion: see section 5.

Materials to avoid/Reactivity

Reacts with galvanised steel or unlined mild steel to produce hydrogen, a highly flammable gas that could explode.

11. TOXICOLOGICAL INFORMATION

This section is intended for use by toxicologists and other health professionals.

Data obtained on product and components are summarized below.

Acute oral toxicity
Rat, LD50: 5,108 mg/kg body weight
Practically non-toxic.
FIFRA category IV.
Acute dermal toxicity
Rat, LD50 (limit test): > 5,000 mg/kg body weight
Practically non-toxic.
FIFRA category IV.
No mortality.
Acute inhalation toxicity
Rat, LC50, 4 hours, aerosol: 2.9 mg/L
Other effects: weight loss, breathing difficulty
Practically non-toxic.
FIFRA category IV.
Skin irritation
Rabbit, 6 animals, OECD 404 test:
Days to heal: 3
Primary Irritation Index (PII): 0.5/8.0
Essentially non irritating.
FIFRA category IV.
Eye irritation
Rabbit, 6 animals, OECD 405 test:
Days to heal: 3
Slight irritation.
FIFRA category III.
Skin sensitization
Guinea pig, Buehler test:
Positive incidence: 0 %

N-(phosphonomethyl)glycine; {glyphosate}

Mutagenicity
In vitro and in vivo mutagenicity test(s):
Not mutagenic.
Repeated dose toxicity
Rabbit, dermal, 21 days:
NOAEL toxicity: > 5,000 mg/kg body weight/day
Target organs/systems : none
Other effects: none
Rat, oral, 3 months:
NOAEL toxicity: > 20,000 mg/kg diet
Target organs/systems : none
Other effects: none
Carcinogenicity
Mouse, oral, 24 months:
NOEL tumour: > 30,000 mg/kg diet
NOAEL toxicity: ~ 5,000 mg/kg diet
Tumours: none
Target organs/systems : liver
Other effects: decrease of body weight gain, histopathologic effects
Rat, oral, 24 months:
NOEL tumour: > 20,000 mg/kg diet
NOAEL toxicity: ~ 8,000 mg/kg diet

Tumours: none
Target organs/systems: eyes
Other effects: decrease of body weight gain, histopathologic effects

Toxicity to reproduction/fertility

Rat, oral, 3 generations:
NOAEL toxicity: > 30 mg/kg body weight
NOAEL reproduction: > 30 mg/kg body weight
Target organs/systems in parents: none
Other effects in parents: none
Target organs/systems in pups: none
Other effects in pups: none

Developmental toxicity/teratogenicity

Rat, oral, 6 - 19 days of gestation:
NOAEL toxicity: 1,000 mg/kg body weight
NOAEL development: 1,000 mg/kg body weight
Other effects in mother animal: decrease of body weight gain, decrease of survival
Developmental effects: weight loss, post-implantation loss, delayed ossification
Effects on offspring only observed with maternal toxicity.

Rabbit, oral, 6 - 27 days of gestation:
NOAEL toxicity: 175 mg/kg body weight
NOAEL development: 175 mg/kg body weight
Target organs/systems in mother animal: none
Other effects in mother animal: decrease of survival
Developmental effects: none

12. ECOLOGICAL INFORMATION

This section is intended for use by ecotoxicologists and other environmental specialists.

Data obtained on product and components are summarized below.

Aquatic toxicity, fish

Rainbow trout (Oncorhynchus mykiss):
Acute toxicity, 96 hours, static, LC50: 5.4 mg/L
moderately toxic

Bluegill sunfish (Lepomis macrochirus):
Acute toxicity, 96 hours, static, LC50: 7.3 mg/L
moderately toxic

Aquatic toxicity, invertebrates

Water flea (Daphnia magna):
Acute toxicity, 48 hours, static, EC50: 11 mg/L
slightly toxic

Avian toxicity

Mallard duck (Anas platyrhynchos):
Dietary toxicity, 5 days, LC50: > 5,620 mg/kg diet
practically non-toxic

Bobwhite quail (Colinus virginianus):
Dietary toxicity, 5 days, LC50: > 5,620 mg/kg diet
practically non-toxic

Arthropod toxicity

Honey bee (Apis mellifera):
Oral/contact, 48 hours, LD50: > 100 µg/bee
practically non-toxic

Soil organism toxicity, invertebrates

Earthworm (Eisenia foetida):
Acute toxicity, 14 days, LC50: > 1,250 mg/kg soil
practically non-toxic

N-(phosphonomethyl)glycine; {glyphosate}

Bioaccumulation
Bluegill sunfish (Lepomis macrochirus):
Whole fish: BCF: < 1
No significant bioaccumulation is expected.

Dissipation
Soil, field:
Half life: 2 - 174 days
Koc: 884 - 60,000 L/kg
Adsorbs strongly to soil.
Water, aerobic:
Half life: < 7 days

13. DISPOSAL CONSIDERATIONS

Product
Recycle if appropriate facilities/equipment available.
Burn in special, controlled high temperature incinerator.
Dispose of as hazardous industrial waste.
Keep out of drains, sewers, ditches and water ways.
Follow all local/regional/national regulations.

Container
Triple rinse empty containers.
Pour rinse water into spray tank.
Store for collection by approved waste disposal service.
Dispose of as non hazardous industrial waste.
Do NOT re-use containers.
Follow all local/regional/national regulations.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

Not hazardous under the applicable DOT, ICAO/IATA, IMO, TDG and Mexican regulations.

15. REGULATORY INFORMATION

TSCA Inventory
All components are on the US EPA's TSCA Inventory

OSHA Hazardous Components
Surfactant

SARA Title III Rules
Section 311/312 Hazard Categories
Immediate

Section 302 Extremely Hazardous Substances
Not applicable.
Section 313 Toxic Chemical(s)
Not applicable.

CERCLA Reportable quantity
Not applicable.

16. OTHER INFORMATION

The information given here is not necessarily exhaustive but is representative of relevant, reliable data.
Follow all local/regional/national regulations.
Please consult supplier if further information is needed.
In this document the British spelling was applied.
All tests were conducted following OECD guidelines for Good Laboratory Practices (GLP).
The information given here is not necessarily exhaustive but is representative of relevant, reliable data.
For more information refer to product label.
Please consult Monsanto if further information is needed.
Follow all local/regional/national regulations.
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Full denomination of most frequently used acronyms. BCF (Bioconcentration Factor), BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), EC50 (50% effect concentration), ED50 (50% effect dose), I.M. (intramuscular), I.P. (intraperitoneal), I.V. (intravenous), Koc (Soil adsorption coefficient), LC50 (50% lethality concentration), LD50 (50% lethality dose), LDLo (Lower limit of lethal dosage), LEL (Lower Explosion Limit), LOAEC (Lowest Observed Adverse Effect Concentration), LOAEL (Lowest Observed Adverse Effect Level), LOEC (Lowest Observed Effect Concentration), LOEL (Lowest Observed Effect Level), MEL (Maximum Exposure limit), MTD (Maximum Tolerated Dose), NOAEC (No Observed Adverse Effect Concentration), NOAEL (No Observed Adverse Effect Level), NOEC (No Observed Effect Concentration), NOEL (No Observed Effect Level), OEL (Occupational Exposure Limit), PEL (Permissible Exposure Limit), PII (Primary Irritation Index), Pow (Partition coefficient n-octanol/water), S.C. (subcutaneous), STEL (Short-Term Exposure Limit), TLV-C (Threshold Limit Value-Ceiling), TLV-TWA (Threshold Limit Value - Time Weighted Average), UEL (Upper Explosion Limit)

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-APPROVED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety, and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course. Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of federal law to use a pesticide product in any manner not prescribed on the EPA-approved label.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, MONSANTO Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for the purposes prior to use. In no event will MONSANTO Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR TO THE PRODUCT TO WHICH INFORMATION REFERS.

APPENDIX B

Air Quality Analysis

Appendix B. Air Quality Analysis

Procedures and equations used to calculate air emissions for the proposed five-year snowy plover habitat restoration project are detailed below.

Technical Assumptions and Emission Calculation

Proposed Action

The Proposed Action would restore Western snowy plover (*Charadrius alexandrinus nivosus*) breeding habitat over a five year period starting in 2008 by removing invasive, non-native, plant species in selected coastal dune areas; revegetating with native dune species where appropriate; and implementing annual maintenance, as needed, to prevent re-establishment of non-native species. Invasive, plant species targeted for removal include European beachgrass (*Ammophila arenaria*), iceplant (*Carpobrotus* spp.); and Sydney golden wattle (*Acacia longifolia*). Eradication methods would include manual removal, mechanical removal, prescribed fire, chemical treatment, or a combination of any of these. Mechanical contouring of dunes would occur in selected areas to create dune structures optimal for snowy plover breeding habitat. Revegetation would be implemented in areas where dune contouring is accomplished, where stabilization of the sand is deemed necessary to prevent exposure of buried sensitive cultural sites, where special status plant species may be buried during the invasive plant eradication process, and where vegetation is removed to establish temporary emergency firebreaks.

The Vandenberg Air Force Base Fire Protection Flight Hot Shot Crew (30 CES/CEFOH) would implement the prescribed fire treatment. 30 CES/CEFOH is developing a plan for the prescribed fire and will submit the plan and obtain necessary permits from the Santa Barbara County Air Pollution Control District (SBCAPCD) as part of the Vandenberg Air Force Base Prescribed Fire Plan for 2008. Thus, emissions resulting from prescribed fire are not addressed in this Appendix.

Table B-1 presents equipment usages for the estimated reasonable daily worst-case scenario, including equipment size and load factors. Table B-2 shows the emissions factors used in this analysis, and Table B-3 and Table B-4 show the reasonable estimated worst-case daily and total project emissions.

Sources of air emissions from the Proposed Action would include combustive and fugitive emissions. Combustive emission would come from ATVs, construction equipment, employee commuting, and trucks. Fugitive emissions would come from construction equipment disturbing the sites.

Combustive Emissions

For combustive emissions from construction equipment, the daily emissions were be calculated by multiplying the equipment horsepower, the load factor, the emission factor, the number of equipment, and the hours of operation for one day. Project emissions were obtained by multiplying

the equipment horsepower, the load factor, the emission factor, the number of equipment, and the hours operation for the five year project.

Vehicular emissions from employees commuting and truck trips were estimated by multiplying the number of vehicles per day, the number of trips, the distance traveled, and the emission factor. Project emissions were obtained by multiplying the number of vehicles per day, the number of trips, the distance traveled, the numbers of days in the Proposed Action, and the emission factor. The average, one-way employee commute was estimated at 25 miles. Travel distances for trucks delivering services, materials, and equipment would vary with some traveling 10 miles one way while others would travel 25 miles. Emission factors for commuting employees and trucks associated with project activities under the Proposed Action materials were obtained from California Air Resources Board's EMFAC 2007 (v2.3) BURDEN model run by the South Coast Air Quality Management District. The emission factors for employee commuting and project trucks are shown in Table B-2.

Fugitive Dust

Equipment operating within the restoration project areas would disturb soil and create fugitive dust. Project disturbance areas were estimated from maps included in the Environmental Assessment for the Western Snowy Plover Habitat Restoration. The 75-acre disturbance area included disturbance on access trails and within restoration sites. The total average daily disturbed area was obtained by dividing this total disturbance area by 130 annual project days.

Daily fugitive dust emissions were estimated by multiplying the hours of operation by the emission factor of 3.49 pounds of particulate matter 10 microns or less in diameter (PM_{10}) per acre per hour (SBCAPCD). The project PM_{10} emissions were estimated by multiplying daily emissions by the number of days of disturbance over the five-year period. The reasonable worst-case day was assumed to disturb three times the area of an average day.

Table B-1. Estimated daily equipment usage for Proposed Action.

Equipment	Horse Power	Load Factor	# of Pieces of Equipment	Project Days	Hours/ Day	Total Hours
Polaris Range ATV	40	0.48	1	400	4.00	1,600
Honda GE-75 Pump	3	1	1	400	6.00	2,400
Rayco C87L Loader	87	0.59	1	3	8.00	24
Caterpillar D8N bulldozer	285	0.59	1	15	8.00	120
Yamaha Grizzly 660 ATV	27	0.48	4	4	8.00	128
Sithl 460 Chainsaw	6	0.7	4	4	8.00	128
Chevrolet K1500 Utility Truck [(a)]	25	2	2	80	NA	800
Dodge 3500 Utility Truck [(a)]	25	2	2	50	NA	500
Ford F-450 Utility Truck [(a)]	10	2	2	4	NA	8
Ford F-850 Fire Crew Truck [(a)]	10	2	2	4	NA	8
Fugitive Dust Worst-Case Day [(b)]	1.73	NA	NA	1	8	8
Fugitive Dust Average Day [(b)]	0.58	NA	NA	649	6	3,894

NOTES:
(a) For this source, Horsepower indicates number of miles for a one-way trip, # of Pieces of Equipment indicates the number of one-way trips per day, and Total Hours indicates the total number of one-way trips.
(b) For this source, Horsepower indicates number of acres disturbed in one day and Total Hours indicates the number of hours of disturbance.

Table B-2. Construction equipment emission factors for Proposed Action.

Emission Source	CO	NO_x	PM_{10}	ROG	SO_x	Ref.	Category
Polaris Range ATV	258.5520	4.9896	0.0227	11.3400	0.2268	(1)	Other Construction Equipment [(a)]
Honda GE-75 Pump	1.6481	2.7942	0.2117	0.4869	0.0030	(2)	Pumps [(a)]
Rayco C87L Loader	3.4755	2.9230	0.3284	1.3944	0.0036	(2)	Tractors/Loaders/Backhoes[(a)]
Caterpillar D8N bulldozer	1.5376	2.9681	0.1571	0.3515	0.0031	(2)	Other Construction Equipment [(a)]
Yamaha Grizzly 660 ATV	258.5520	4.9896	0.0227	11.3400	0.2268	(1)	Other Construction Equipment [(a)]
Sithl 460 Chainsaw	2.1500	0.0021	0.0014	0.6840	0.0008	(3)	Chainsaws >4 Hp [(a)]
Chevrolet K1500 Utility Truck	0.0105	0.0011	0.0001	0.0011	0.0000	(4)	Passenger Vehicles [(b)]
Dodge 3500 Utility Truck	0.0105	0.0011	0.0001	0.0011	0.0000	(4)	Passenger Vehicles [(b)]
Ford F-450 Utility Truck	0.0105	0.0011	0.0001	0.0011	0.0000	(4)	Passenger Vehicles [(b)]
Ford F-850 Fire Crew Truck	0.0105	0.0011	0.0001	0.0011	0.0000	(4)	Passenger Vehicles [(b)]
Fugitive Dust	0.00	0.00	3.49	0.00	0.00	(5)	SBCAPCD Form 24 [(c)]

REFERENCES:
(1) SCAQMD CEQA Air Quality Handbook - Tables A9-8-A
(2) SCAQMD CEQA Off-Road Emission Factors – 2008
(3) SCAQMD CEQA Air Quality Handbook - Table A9-8-B
(4) SCAQMD CEQA On-Road Emission Factors Emfac 2007 Version 2.3 - 2008
(5) SBCAPCD Form 24 Construction Equipment Emission Factors

NOTES:
(a) Emission factors are in g/hp-hr
(b) Emission factor from SCAQMD CEQA On-Road Vehicles are in lbs/mile
(c) Emission factor is controlled in units of lbs/acre-hr with PM_{10} fraction 0.64 and Control Efficiency of 50%

Table B-3. Estimated daily emissions for Proposed Action.

Emission Source	Daily Emissions (Lbs/day)				
	CO	NO_x	PM_{10}	ROG	SO_x
Polaris Range ATV	43.78	0.84	0.00	1.92	0.04
Honda GE-75 Pump	0.07	0.11	0.01	0.02	0.00
Rayco C87L Loader	3.15	2.65	0.30	1.26	0.00
Caterpillilar D8N bulldozer	4.56	8.80	0.47	1.04	0.01
Yamaha Grizzly 660 ATV	236.39	4.56	0.02	10.37	0.21
Sithl 460 Chainsaw	0.64	0.00	0.00	0.03	0.00
Chevrolet K1500 Utility Truck	1.05	0.11	0.01	0.11	0.00
Dodge 3500 Utility Truck	1.05	0.11	0.01	0.11	0.00
Ford F-450 Utility Truck	0.42	0.04	0.00	0.04	0.00
Ford F-850 Fire Crew Truck	0.42	0.04	0.00	0.04	0.00
Fugitive Dust Worst-Case Day			48.32		
Daily Total	***291.53***	***17.28***	***49.14***	***14.95***	***0.26***

Table B-4. Estimated project emissions for Proposed Action.

Emission Source	Project Emissions (Lbs)				
	CO	NO_x	PM_{10}	ROG	SO_x
Polaris Range ATV	17,510.40	337.92	1.54	768.00	15.36
Honda GE-75 Pump	26.16	44.35	3.36	7.73	0.05
Rayco C87L Loader	9.44	7.94	0.89	3.79	0.01
Caterpillar D8N bulldozer	68.40	132.03	6.99	15.64	0.14
Yamaha Grizzly 660 ATV	945.56	18.25	0.08	41.47	0.83
Sithl 460 Chainsaw	2.55	0.00	0.00	0.81	0.43
Chevrolet K1500 Utility Truck	421.94	44.12	3.40	43.17	0.43
Dodge 3500 Utility Truck	263.71	27.57	2.13	26.98	0.27
Ford F-450 Utility Truck	1.69	0.18	0.01	0.17	0.00
Ford F-850 Fire Crew Truck	1.69	0.18	0.01	0.17	0.00
Fugitive Dust			7,840.42		
Total (Lbs)	***19,251.53***	***612.53***	***7,858.83***	***907.93***	***17.52***
Total (Tons)	***9.63***	***0.31***	***3.93***	***0.45***	***0.01***

APPENDIX C

Cultural Resources

Appendix C – Cultural Resources

Prehistory

The prehistory of California's central coast spans the entire Holocene and may extend back to late Pleistocene times. Excavations on VAFB reveal occupations dating back 9,000 to 10,000 years (Glassow 1990, 1996; Lebow et al. 2001, 2006, 2007). These early occupants are thought to have lived in small groups that had a relatively egalitarian social organization and a forager-type land-use strategy (Erlandson 1994; Glassow 1996; Greenwood 1972; Moratto 1984). Human population density was low throughout the early and middle Holocene (Lebow et al. 2007) but cultural complexity appears to have increased around 3,000–2,500 years ago (King 1981, 1990). At VAFB, that interval also marks the beginning of increasing human population densities and appears to mark the shift from a foraging to a collecting land-use strategy (Lebow et al. 2006, 2007). Population densities reached their peak around 600–800 years ago, corresponding to the full emergence of Chumash cultural complexity (Arnold 1992).

People living in the VAFB area prior to historic contact are grouped with the Purisimeño Chumash (Greenwood 1978; King 1984; Landberg 1965), one of several linguistically related members of the Chumash culture. In the Santa Barbara Channel area, the Chumash people lived in large, densely populated villages and had a culture that "was as elaborate as that of any hunter-gatherer society on earth" (Moratto 1984). Relatively little is known about the Chumash in the Vandenberg region, but explorers noted that villages were smaller and lacked the formal structure found in the channel area (Greenwood 1978). About five ethnohistoric villages are identified by King (1984) on VAFB, along with another five in the general vicinity. Beginning with the maritime voyages of Cabrillo in A.D. 1542–1543 diseases introduced by early Euroamerican explorers, substantially impacted Chumash populations more than 200 years before Spanish occupation began (Erlandson and Bartoy 1995, 1996; Preston 1996). Drastic changes to Chumash lifeways resulted from the Spanish occupation that began with the Portolá expedition in A.D. 1769.

History

VAFB history is divided into the Mission, Rancho, Anglo-Mexican, Americanization, Regional Culture, and Suburban periods (Palmer 1999). The Mission Period began with the early Spanish explorers and continued until 1820. During this period the Vandenberg area was within the lands controlled by Mission La Purísima, and farming and ranching were the primary economic activities. The Rancho Period began in 1820 and continued until 1845. Following secularization in 1834, the Alta California government granted former mission lands to Mexican citizens as ranchos. Cattle ranching was the primary economic activity during this period. The Bear Flag Revolt and the Mexican War marked the beginning of the Anglo-Mexican Period (1845–1880). Cattle ranching continued to flourish during the early part of this period, but severe droughts during the 1860s decimated cattle herds. The combination of drought and change in government from Mexican to the United States caused substantial changes in land ownership and sheep ranching and grain farming replaced the old rancho system. Increased population densities characterize the Americanization Period (1880–1915). Beginning in the late 1890s, the railroad provided a more efficient means of shipping and receiving goods and supplies, which in turn increased economic activity. Ranching and farming continued during the early part of the period of Regional Culture (1915–1945), until

World War II when property was condemned for construction of Camp Cooke. The Suburban Period (1945–1965) began with the end of World War II. In 1956, the army transferred 64,000 acres of North Camp Cooke to the Air Force, and it was renamed Cooke Air Force Base. In 1958 the base had its first launch, a Thor ballistic missile, and was renamed VAFB (Palmer 1999).

Area B is immediately west of SLC-10, one of three Thor launch complexes built on North VAFB in the late 1950s. The three launch pads of SLC-10 were originally built to support training by Royal Air Force crews who would be manning Thor Launch facilities in Europe. The first launch came on 16 April 1959, with numerous additional launches over the next three years (Nowlan et al. 1996). In early 1962, the Air Force dismantled the launch pad at what is now called SLC-10W and transported it to Johnson Island where it was used in several attempts to launch a nuclear warhead 200-plus miles into space for high altitude detonations. This program had several failures, including one in which the missile, with a nuclear warhead aboard, was accidentally blown up on the pad. As a result of the destruction and subsequent cleanup of radioactive debris the other two launch pads at SLC-10 were dismantled and sent to Johnson Island to support the remaining tests. Subsequently, the Thor was repurposed for use in the antisatellite program. The two pads at Johnson Island and an identical one built at SLC-10E for training purposes were developed into a system for knocking down Soviet satellite systems using nuclear warheads. It went operational in June of 1964. SLC-10 also saw launches related to the Thor/Burner program, placing secret satellites into orbit. Satellite launches continued at SLC-10 until July of 1980.

SLC-10 became a National Historic Landmark in 1986 as an example of a "highly technical" and "scientific" facility, as discussed in the Advisory Council on Historic Preservation's (ACHP) 1991 publication *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities*. Designating SLC-10 as a National Historic Landmark was a compromise between the Air Force and the National Park Service, who originally wanted to nominate SLC-2W, an active launch facility. SLC-10 was nominated on the basis of being the best surviving example of a launch complex built in the 1950s at the beginning of the American effort to explore space. It now houses the Vandenberg Missile Heritage Center.

Area D is near the old community of Surf. In August 1896, the Southern Pacific Railroad reached the south bank of the Santa Ynez River. Between 1896 and 1897 a place was leveled for the railroad station and for the water tanks at post mile 302.7. The Surf Depot (on the east side of the tracks) was constructed in 1900 by J. W. Maurice, and train service from the station began in March 1901. The Surf Post Office was opened in June 1897, south of the depot and on the east side of the tracks. A small stand of cypress trees still mark the location. Over the years the railroad community surrounding the depot grew to include warehouses, residences (houses and converted box cars), water tanks, and oil tanks. Henry Morinini ran a hotel and store from 1912 to 1942. When automobiles became more common, he added a Union Oil gas station. The store, gas station, and the Morinini residence were just northeast and behind the depot.

In a 1981 letter to the Lompoc Record, a former resident described Surf as it was between 1927 and 1939: "I lived on the ocean side of the tracks along with quarters for section personnel and section foreman and the water tender for the depot. An old coach was in front of the house. East (north) of depot was the old wooden coaches for telegraphers, and back of depot was the Morinini store and next door (to the south) was the post office."

Between 1941 and 1942 the U.S. Army took over land surrounding Surf Depot. The Salvation Army established a branch of the United Service Organizations (USO) in 1943. By 1945, 30,000 troops came though every month. The USO was closed in May 1946. In 1957 Camp Cooke Air Force Base was established on the former Camp Cooke Army Base, north of the Santa Ynez River, while the Pacific Naval Missile Facility was established south of the river in May 1958 (Palmer 1999). The Navy controlled the land around the depot and railroad village at Surf. At this time there were

telegraphers, track crews, maintenance men, the assistant trainmaster, and their families living at Surf. “About 40 people lived in 14 houses (from ‘log cabins’ built of railroad ties, converted box cars, to conventional houses”) (Lompoc Legacy 2005).

In 1962, the Lompoc Record published an article on the railroad town at Surf, titled “Surf: A Front Row Seat.” The article detailed the evacuation procedures taken by the Navy to protect the Surf residents during a missile launch. An accompanying picture shows the residences located on the west side of the tracks as they appeared in 1962. In this photo the caption states that the section foreman, Jim Galanos, lived in a two-story house near the far grove of trees. These cypress trees are still present. Most of the buildings were subsequently removed.

Bibliography

Advisory Council on Historic Preservation. 1991. Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities. Washington D.C.

Arnold, J.E. 1992. Complex Hunter-Gatherer-Fishers of Prehistoric California: Chiefs, Specialists, and Maritime Adaptations of the Channel Islands. American Antiquity 57:60–84.

Erlandson, J.M. 1994. Early Hunter-Gatherers of the California Coast. Plenum, New York.

Erlandson, J.M., and K. Bartoy. 1995. Cabrillo, the Chumash, and Old World Diseases. Journal of California and Great Basin Anthropology 17:153–173.

Erlandson, J.M., and K. Bartoy. 1996. Protohistoric California: Paradise or Pandemic? Proceedings of the Society for California Archaeology 9:304–309.

Glassow, M.A. 1990. Archaeological Investigations on Vandenberg Air Force Base in Connection with the Development of Space Transportation System Facilities, with contributions by Jeanne E. Arnold, G. A. Batchelder, Richard T. Fitzgerald, Brian K. Glenn, D. A. Guthrie, Donald L. Johnson, and Phillip L. Walker. Department of Anthropology, University of California, Santa Barbara. Submitted to U.S. Department of the Interior, National Park Service, Western Region Interagency Archeological Services Branch, San Francisco, Contract No. CX-8099-2-0004.

Glassow, M.A. 1996. Purisimeño Chumash Prehistory: Maritime Adaptations along the Southern California Coast. Case Studies in Archaeology. Jeffrey Quilter, series editor. Harcourt Brace College Publishers, San Diego.

Greenwood, R.S. 1972. 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California. San Luis Obispo County Archaeological Society Occasional Paper No. 7.

Greenwood, R.S. 1978. Obispeño and Purisimeño Chumash. In California, edited by Robert F. Heizer, pp. 520–523. Handbook of North American Indians, vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

King, C.D. 1981. The Evolution of Chumash Society: A Comparative Study of Artifacts Used in Social System Maintenance in the Santa Barbara Channel Region before A.D. 1804. Ph.D. dissertation, Department of Anthropology, University of California, Davis.

King, C.D. 1984. Ethnohistoric Background. In Archaeological Investigations on the San Antonio Terrace, Vandenberg Air Force Base, California, in Connection with MX Facilities Construction, pp. I-1–I-54. Chambers Consultants and Planners, Stanton, California. Submitted to U.S. Army Corps of Engineers, Los Angeles District, Contract No. DAC09-81-C-0048.

King, C.D. 1990. Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region before A.D. 1804. The Evolution of North American Indians, edited by David Hurst Thomas. Garland, New York.

Lebow, C.G., D.R. Harro, R.L. McKim, and C. Denardo. 2001. Archaeological Excavations at CA-SBA-246, An Early Holocene Site on Vandenberg Air Force Base, Santa Barbara County, California. Applied EarthWorks, Inc., Fresno, California, for Tetra Tech, Inc., Santa Barbara, California. Submitted to 30 CES/CEV, Vandenberg Air Force Base, California, USAF Contract No. F04684-95-C-0045.

Lebow, C.G., R.L. McKim, D.R. Harro, and A.M. Munns. 2006. Prehistoric Land Use in the Casmalia Hills throughout the Holocence: Archaeological Investigations along Combar Road, Vandenberg Air Force Base, California. 2 vols. Applied EarthWorks, Inc., Lompoc, California. Submitted to 30th Civil Engineer Squadron, Environmental Flight (30 CES/CEVNC), Vandenberg Air Force Base, California.

Lebow, C.G., R.L. McKim, D.R. Harro, A.M. Munns, and C. Denardo. 2007. Littoral Adaptations throughout the Holocene: Archaeological Investigations at the Honda Beach Site (CA-SBA-530), Vandenberg Air Force Base, Santa Barbara County, California. 2 vols. Applied EarthWorks, Inc., Lompoc, California. Submitted to 30th Civil Engineer Squadron, Environmental Flight (30 CES/CEVNC), Vandenberg Air Force Base, California.

Lompoc Legacy. 2005. April issue. Lompoc Valley Historical Society, Lompoc, California.

Moratto, M.J. 1984. California Archaeology. Academic Press, New York and London.

Nowlan, P., S. Ellsworth, R. McCullough, M. Metzinger, J. Gorski, and A. Bonhert. 1996. Cold War Properties Evaluation—Phase I, Inventory and Evaluation of Launch Complexes and Related Facilities at Vandenberg Air Force Base, California, for the United States Air Force. Tri-Services Cultural Resources Research Center, U.S. Army Construction Engineering Research Laboratories, Champaign, Illinois. Prepared for U.S. Department of Defense Legacy Resource Management Program, Washington, D.C.

Palmer, K. 1999. Central Coast Continuum—From Ranchos to Rockets: A Contextual Historic Overview of Vandenberg Air Force Base, Santa Barbara County, California. Prepared by Palmer Archaeology and Architecture Associates, Santa Barbara, California. Draft submitted to 30 CES/CEVPC, Vandenberg Air Force Base, California.

Preston, W. 1996. Serpent in Eden: Dispersal of Foreign Diseases into Pre-Mission California. Journal of California and Great Basin Anthropology 18:2–37.